SCIENCE, TECHNOLOGY, HEALTH

Engineering Degree in Embedded Systems Automation Sensors

Level of qualification:
Master's degree

ECTS
180 credits

Duration
3 years, 6 semesters

Available tracks

- Embedded Systems Automation Sensors Embedded Systems Automation Sensors - Work-study program
-

Overview

Digital, embedded, and communication systems, as well as automated, instrumented, and intelligent systems, are present in major sectors such as transportation, home automation, and industry in general, and cover a range of developing professions. In the information processing chain, the Digital Systems - Instrumentation engineer:

- provides the link between the physical world and the digital world;
- designs and implements processing systems with a high software component embedded in equipment or distributed across production sites;
- designs and implements systems that communicate with each other for the purposes of measurement, observation, control, production of reliable mass data, etc.

Objectives

The aim of this program is to train engineers with generalist skills in engineering sciences, supplemented by professional training focused on three main areas: smart electronic equipment, engineering, and computer science. The program is multidisciplinary in the fields of digital systems, connected objects, and smart instrumentation. The courses cover a spectrum ranging from applied physics to instrumentation and measurement, computer and embedded systems, electronics, data processing, and automation.

International dimension

100% of students go abroad

- either by spending a semester studying at a foreign university under inter-institutional agreements
- or by doing an internship abroad, in a company or laboratory, thanks to the School's network of partners

https://www.polytech.univ-smb.fr/international/ mobilite.html

The advantages of the program

This program differs from other engineering programs in that it combines skills in digital, embedded, and communication systems, systems control

systems and data science with skills in physics applied to instrumentation and measurement.

Organization

Expected enrollment

24 places for students 24 places for apprentices

Study accommodations

The Disability Support Service and the High-Level Sports (SHN) / High-Level Artist (AHN) program offer study accommodations.

Find out more

Admission

Who is the program for?

- Integrated preparatory class
- CPGE students,
- Undergraduate students (L2, DUT, or equivalent)

http://www.polytech-reseau.org/postuler-a-polytech/cycle-ingenieur/

Apply and register

Apply / Register

And after

Further studies at USMB

- Doctorate
- Master's in Business Management and Administration

Targeted professions and career opportunities

- Research and development engineer, digital systems research and development engineer, engineer/researcher
- Design and development engineer, Project engineer, Instrumentation/electronics engineer, Industrial IT engineer, Embedded systems engineer, Automation/control-command-supervision engineer
- Digital systems research and development engineer, data science engineer, information technology engineer, embedded systems engineer, project engineer
- Systems Engineer, Technical Engineer, Maintenance Engineer

Practical information

Contact

Admission to Polytech Annecy-Chambéry

admission@polytech-annecy-chambery.fr

Partner laboratories

Systems and Materials for Mechatronics Laboratory (SYMME)
http://www.symme.univ-smb.fr/

Laboratory for Computer Science, Systems, Information and Knowledge Processing (LISTIC) https://www.listic.univ-smb.fr/

Campus

Annecy / Annecy-le-Vieux campus

Find out more

Become a Digital Systems Engineer - Instrumentation
https://www.polytech.univ-smb.fr/formation/systemes-numeriques-instrumentation/ingenieur-systemes-numeriques-instrumentation.html

Program

Embedded Systems Automation Sensors

IGE3 - Embedded Systems Automation Sensors

Semester 5

	Type	Lecture	Tutorial	Practical	Credits
UE501 Gateway to the professional environment	UE				8 credits
English S5 Sports	MODULE		40.5		
Business Management Simulation	MODULE		21		
Skills development support Optional internship S5	MODULE		12		
Support (every Thursday afternoon)	MODULE				
	MODULE	3 hours			
	MODULE				
	MODULE				
UE502 Engineering Sciences and Tools	UE				9 credits
Sustainable Development	MODULE	15 hours	12 hours	12	
Algorithms and Python Programming	MODULE	3 hours	6 hours		
Databases (basics of business information management) MAraTHon: Support/Refresher course	MODULE	6	4.5	12	
Mathematics Core Curriculum	MODULE				
	MODULE	16.5	37.5		
UE503 Engineering Sciences	UE				13 credits
Automation	MODULE	6 hours	13.5	20 40	
Experimental introduction to the SNI Programming C specialty	MODULE	6	6	12	
	MODULE				
Material properties Electricity	MODULE	17 hours	9 hours	8 hours	
	MODULE	13.5 hours	15 hours	12 hours	

Semester 6

	Subject	Lectures	Tutorial	Practical	Credits
UE601 Gateway to the professional environment	UE				8 credits
Professional experience Financial management	MODULE	10.5	9		
	MODULE				
Introduction to law	MODULE	15 hours	4.5		
Issues in artificial intelligence	MODULE				
Business-oriented project management techniques	MODULE	6 hours	9		
English (TOEIC level not achieved) S6 Modern languages (TOEIC level achieved)	MODULE		40.5		
	MODULE				
English S6	SUBJECT		15		

Modern Language 2	CHOICE				
German TD	SUBJECT		3 p.m.		
Spanish TD Italian	SUBJECT		3 p.m.		
TD Chinese TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Russian TD	SUBJECT		3 p.m.		
Advanced English S6 Optional internship	SUBJECT		3 p.m.		
S6	SUBJECT		9 p.m.		
Support (every Thursday afternoon when FISA staff are present)	MODULE				
	MODULE				
UE602 Instrumentation and project-based learning	UE				8 credits
Electromagnetism and optics applied to information transmission Project-based learning	MODULE	23.5 hours	18	20	
Instrumentation electronics: essential concepts for engineers	MODULE	12	12	12	
	MODULE				
UE603 Information Processing and Automation	UE				10 credits
Signals and Systems	MODULE	12 hours	12 hours	12 hours	
Signals and images: basic operators Mathematics	MODULE	13.5 hours	13.5 hours	9 hours	
Introduction to Machine Learning	MODULE	18	18		
	MODULE	18	6 p.m.		
UE604 Embedded Computing	UE				4 credits
Databases and Web Technologies Embedded Systems I	MODULE		13.5		
	MODULE	9 hours	3	24	

IGE4 - Embedded Systems Automation Sensors

Semester 7

	Nature	Lecture	Tutorial	Practical	Credits
UE701 Gateway to the professional environment	UE				6 credits
Resources and professional dynamics Creativity and innovation	MODULE		13.5 hours	3.5	
management English (TOEIC level not achieved) S7 Modern languages	MODULE		25.5		
(TOEIC level achieved)	MODULE		40.5		
English S7 Modern	MODULE				
Language 2	MODULE		15		
German TD Spanish	SUBJECT				
TD Italian TD	CHOICE		15	15	
Chinese TD			15	15	
Japanese TD	SUBJECT		15	15	
Russian TD			21		
Advanced English S7 Optional internship	SUBJECT				
S7	SUBJECT				
Support (half of Thursday afternoons when FISA staff are present)	SUBJECT				
	SUBJECT				
	SUBJECT				
	SUBJECT				
	SUBJECT				
	MODULE				
	MODULE				

UE702 Instrumentation	UE				8 credits
Data acquisition systems - Graphical programming Functional materials for instrumentation	MODULE	4.5		32	
	MODULE	21.5	18		
Actuator sizing	MODULE	7.5 hours	4.5 hours	12	
UE703 Information processing and automation	UE				7 credits
Random signals	MODULE	12	12h	12h	
Automation - Stability and control of systems Probability - Statistics	MODULE	hours	10.5h 18	16h	
	MODULE	10 hours			
		18 hours			
UE704 Embedded Computing and Project-Based Learning	UE				9 credits
Networks and Security for Embedded Systems Project-Based Learning	MODULE	25.5 hours		36	
Embedded Systems and Concurrent Programming	MODULE				
	MODULE	9	3	24	

Semester 8

	Nature	Lectures	TD	Practical work	Credits
UE801 Gateway to the professional environment	UE				6 credits
Integrated QSE (Quality, Safety, Environment) Management System Management Techniques	MODULE	9am 6pm	10.5		
English (TOEIC level not achieved) S8 Modern Languages (TOEIC level achieved)	MODULE		7.5 40.5		
English S8 Modern Language 2	MODULE				
German TD Spanish TD Italian TD Japanese TD Chinese TD Russian TD	MODULE		3 p.m.		
Advanced English S6 Optional internship S8	SUBJECT				
Support (half of Thursday afternoons when FISA students are present)	CHOICE		3 p.m. 3 p.m.		
	SUBJECT		3 p.m. 3 p.m.		
	SUBJECT		3 p.m. 3 p.m.		
	SUBJECT		9 p.m.		
	SUBJECT				
	SUBJECT				
	SUBJECT				
	SUBJECT				
	MODULE				
	MODULE				
UE802 Internship	UE				6 credits
Assistant Engineer Internship S8	MODULE				
UE803 Instrumentation and System Control	EU				10 credits
Decentralized Automation	MODULE			24	
Experimental physics, measurements, sensors, and instrumentation	MODULE	16	13.5	hours	
				52 hours	
Discrete event system models and applications	MODULE	9	19.5	12	
UE804 Information processing and project-based learning	UE				8 credits
Image Analysis and Computer Vision Project-Based Learning	MODULE	3 p.m.	1:35 p.m.	12 hours	
Information Processing Project	MODULE				
	MODULE			24	

IGE5 - Embedded Systems Automation Sensors

Semester 9

	Nature	Lecture	Tutorial	Practical	Credits
UE901 Gateway to the professional environment	UE				10 credits
Research and Development Project English (TOEIC level not achieved) S9 Modern Languages (TOEIC level achieved)	MODULE				
English S9 Modern Language 2	MODULE		40.5 hours		
German TD	MODULE				
	SUBJECT		15		
	CHOICE				
	SUBJECT				
Spanish TD Italian	SUBJECT		15		
TD Japanese TD	SUBJECT		hours		
Chinese TD Russian	SUBJECT		15		
TD	SUBJECT		hours		
Advanced English S9	SUBJECT		15		
Optional internship S9	SUBJECT		hours		
	MODULE		15		
			hours		
			15		
			hours		
			21		
			hours		
UE902 Automation and Project-Based Learning	UE				7 credits
State-based approach to automation: representation, control, and observation Project-based learning	MODULE	25.5	25.5	20	
	MODULE				
UE903 Communicating objects	UE				6 credits
Communicating systems, communicating sensors Internet of Things	MODULE			36	
	MODULE	3	9		
UE904 Information processing	UE				7 credits
Advanced Machine Learning	MODULE	12		24h	
3D imaging: acquisition, reconstruction, applications Interdisciplinary project: facial recognition	MODULE	hours		12h	
	MODULE	13.5	10.5	36h	
		hours			

Semester 10

	Type	Lectures	Tutorial	Practical	Credits
UE001 Engineering Internship	UE				30 credits
Engineering Internship S10	MODULE				

Embedded Systems Automation Sensors - Work-Study Program IGE3 - Embedded Systems Automation

Sensors - Work-Study Program Semester 5

	Type	Lecture	Tutorial	Practical	Credits
UE501 SHES - Languages	UE				8 credits
Support (every Thursday afternoon) Labor law and corporate structure 1	MODULE				
	MODULE	20 hours	12		
Introduction to sustainable development and CSR - Cognitive development	MODULE	4 p.m.	12 hours	4	
English	MODULE		37 hours		
UE502 Work experience	UE				4 credits
Project 1 (Launch and follow-up) Development in the	MODULE	1		4	
workplace	MODULE				
UE503 Engineering sciences and tools	UE				18 credits
Electricity	MODULE	13.5 hours	15	12 p.m.	
Skills development support Algorithms and Python programming	MODULE	3 hours	hours	12 p.m.	
	MODULE	3 hours	12 hours		
			6 hours		
Databases (business management information database) Mathematics Core Curriculum	MODULE	6 hours	4.5	12 hours	
Automation	MODULE	16.5 hours	37.5		
	MODULE	6	13.5	20	
C programming Material properties	MODULE	6 hours	6:00 p.m.	12:00 p.m.	
	MODULE	5 p.m.	9:00 p.m.	8:00 p.m.	

Semester 6

	Subject	Lectures	Tutorial	Practical	Credits
UE601 SHES - Languages	UE				4 credits
Introduction to sustainable development and CSR	MODULE	6 hours	4 hours		
Sustainable Development - Site Approach (Environmental Management) Support (every Thursday afternoon when FISA staff are present) English (TOEIC level not achieved)	MODULE	4 hours	6 hours		
English (TOEIC level achieved)	MODULE				
	MODULE		30		
UE602 Work experience	UE				10 credits
Project 1 (Monitoring and reporting) Development in the	MODULE			4	
workplace (4 areas)	MODULE				
UE603 Engineering Sciences	UE				16 credits
Instrumentation electronics: essential concepts for engineers Embedded systems I	MODULE	12 hours	12h 3h	12 hours	
Challenges of artificial intelligence Signals and images: basic operators	MODULE	9 hours	13.5	24 hours	
Electromagnetism and optics applied to information transmission	MODULE	6 hours	18h 12h		
Signals and systems	MODULE	10.5		9:00 a.m.	
	MODULE	22h		8:00 p.m.	
	MODULE	12h		12:00 p.m.	

IGE4 - Embedded Systems Automation Sensors - Work-study program (Annecy)

Semester 7

	Type	Lectures	Tutorial	Practical	Credits
UE701 SHES - Languages	UE				8 credits
Support (half of Thursday afternoons when FISA staff are present) Management	MODULE				
	MODULE		32		
Business structure and entrepreneurship 2 Sustainable development - Product	MODULE	12	12		
approach English (TOEIC level achieved)	MODULE	hours	hours	8	
English (TOEIC level not achieved)	MODULE	4	2		
	MODULE	hours	hours		
			34		
			hours		
			34		
UE702 Work experience	UE				10 credits
Project 2 (launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				
UE703 Engineering Sciences	UE				12 credits
Random signals	MODULE	12	12h 10.5h	12	
Automation - Stability and control systems Functional materials for instrumentation	MODULE	hours 10	15	hours	
Data acquisition systems - Graphical programming Embedded systems and concurrent programming	MODULE	hours		16	
	MODULE	21.5		hours	
	MODULE	hours	3		
		4.5			
		9		32	
				hours	
				24	
				hours	

Semester 8

	Nature	Lectures	Tutorial	Practical	Credits
UE801 SHES - Languages	UE				5 credits
Support (half of Thursday afternoons when FISA staff are present) Management and technical communication	MODULE				
	MODULE	6	4	12	
English (TOEIC level not achieved)	MODULE		40 hours		
English (TOEIC level achieved)	MODULE		40		
UE802 Work experience	UE				7 credits
Project 2 (Monitoring and reporting) Development in the	MODULE			8	
workplace (4 areas)	MODULE				
UE803 Engineering Sciences	UE				18 credits
Decentralized Automation	MODULE			24	
Image Analysis and Computer Vision	MODULE	15 hours	13.5		
Experimental physics, measurements, sensors, and instrumentation Networks and security for embedded systems	MODULE	4 p.m.	13.5	32	
Discrete event system models and applications	MODULE	9 p.m.		hours	
	MODULE	9		36	
			19.5	hours	
				12	

IGE5 - Embedded Systems Automation Sensors - Work-study program (Annecy)

Semester 9

	Type	Lectures	Tutorial	Practical	Credits
UE901 SHES - Languages	UE				7 credits

Legislation, labor law, occupational health, sustainable engineering, decarbonization GEPC, Humanities, management, ergonomics	MODULE	18 hours	8	8	
	MODULE	28			
English (TOEIC level not achieved)	MODULE		26 hours		
English (TOEIC level achieved)	MODULE		26		
UE902 Work experience	UE				10 credits
Project 3 (Launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				
UE903 Engineering Sciences	UE				13 credits
Internet of Things	MODULE	3 hours	9 hours	24	
State-based approach in automation: representation, control, and observation 3D imaging: acquisition, reconstruction, applications	MODULE	25.5 hours	25.5 hours	20 hours	
Advanced Machine Learning	MODULE	10.5	10.5	12 hours	
		12		24 hours	

Semester 10

	Nature	Lectures	Tutorial	Practical	Credits
UE001 Work experience	UE				22 credits
Project 3 (Monitoring and reporting) Development in the	MODULE			12	
workplace (4 areas)	MODULE				
UE002 Engineering Sciences	UE				8 credits
Interdisciplinary project: facial recognition	MODULE			36	
Interdisciplinary project: embedded systems and robotics Communication systems, communication sensors	MODULE			hours	
	MODULE			24	
				hours	
				36	
				hours	

IGE4 - Embedded Systems Automation Sensors - Work-study program (Chambéry)

Semester 7

	Nature	Lectures	Tutorial	Practical	Credits
UE701 SHES - Languages	UE				8 credits
Support (half of Thursday afternoons when FISA staff are present) Management	MODULE				
	MODULE		32		
Business structure and entrepreneurship 2 Sustainable development - Product	MODULE	12	12		
approach English (TOEIC level not achieved)	MODULE	hours	hours		
English (TOEIC level achieved)	MODULE	4	2	8	
	MODULE	hours	hours		
			34		
			hours		
			34		
UE702 Work experience	UE				10 credits
Project 2 (launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				
UE703 Engineering Sciences	UE				12 credits
Automatic - Stability and Control of Systems Random Signals	MODULE	10h	10.5	4 p.m.	
	MODULE	12h	12	12	
				p.m.	

Embedded systems and concurrent programming	MODULE	9 a.m.	3	24	
Data acquisition systems - Graphical programming	MODULE	4.5 hours		32	
EMC	MODULE	9	9	12 hours	2 credits

Semester 8

	Nature	Lecture	Tutorial	Practical	Credits
UE801 SHES - Languages	UE				5 credits
Support (half of the Thursdays when FISA staff are present) Management and technical communication	MODULE MODULE	6	4	12	
English (TOEIC level not achieved)	MODULE		40 hours		
English (TOEIC level achieved)	MODULE		40		
UE802 Work experience	UE				7 credits
Project 2 (Monitoring and reporting) Development in the workplace (4 areas)	MODULE MODULE			8	
UE803 Engineering Sciences	UE				18 credits
Experimental physics, measurements, sensors, and instrumentation	MODULE	12	12	24	3.5 credits
FPGA and PSOC	MODULE	21 hours	9h 13.5h	24 hours	5 credits
Image Analysis and Computer Vision	MODULE	15 hours		12 hours	
Networks and security for embedded systems Signal processing processor (DSP)	MODULE MODULE	25.5 hours 10.5	10.5	36 hours 16	2.5 credits

IGE5 - Embedded Systems Automation Sensors - Work-study program (Chambéry)

Semester 9

	Type	Lecture	Tutorial	Practical	Credits
UE901 SHES - Languages	UE				7 credits
Legislation, labor law, occupational health, sustainable engineering, decarbonization GEPC, Humanities, management, ergonomics	MODULE MODULE	18 hours 28	8	8	
English (TOEIC level not achieved)	MODULE		26 hours		
English (TOEIC level achieved)	MODULE		26		
UE902 Work experience	UE				10 credits
Project 3 (Launch and follow-up) Development in the workplace (progress)	MODULE MODULE	1		8	
UE903 Engineering Sciences	UE				13 credits
Low-power communication systems Real-time operating systems and Linux kernel for embedded systems Advanced machine learning Communication Bus	MODULE MODULE	8 hours		8 p.m. 10	2 credits 3.5 credits
Implementation of 32-bit microcontrollers	MODULE MODULE MODULE	20 hours 12 hours 9 hours 3 hours	9	p.m. 12 a.m. 12 a.m. 8 p.m.	2.5 credits 2.5 credits

Semester 10

	Nature	Lectures	Tutorial	Practical	Credits
UE001 Work experience	UE				22 credits
Project 3 (Monitoring and reporting) Development in the	MODULE			12	
workplace (4 areas)	MODULE				
UE002	UE				8 credits
Interdisciplinary project: Embedded AI	MODULE			36 24	
Interdisciplinary project: Embedded systems and robotics Internet of Things	MODULE				
	MODULE	3	9		

Embedded Systems Automation Sensors

Engineering Degree in Embedded Systems, Automation and Sensors

Presentation Practical information

Campus

Annecy / Annecy-le-Vieux campus

Program

IGE3 - Embedded Systems Automation Sensors

Semester

	Type	Lecture	Tutorial	Practical	Credits
UE501 Gateway to the professional environment	UE				8 credits
English S5 Sports	MODULE		40.5		
Business Management Simulation	MODULE		21		
Skills development support Optional internship S5	MODULE		12		
Support (every Thursday afternoon)	MODULE				
	MODULE	3 hours			
	MODULE				
	MODULE				
UE502 Engineering Sciences and Tools	UE				9 credits
Sustainable Development	MODULE	15 hours	12 hours	12	
Algorithms and Python Programming	MODULE	3 hours	6 hours		
Databases (basics of business information management) MAraTHon: Support/Refresher course	MODULE	6	4.5	12	
Mathematics Core Curriculum	MODULE				
	MODULE	16.5	37.5		
UE503 Engineering Sciences	UE				13 credits
Automation	MODULE	6	13.5	20 40	
Experimental discovery of the SNI specialty C programming	MODULE	6	6	12	
	MODULE				
Material properties Electricity	MODULE	17 hours	9 hours	8 hours	
	MODULE	13.5 hours	15 hours	12 hours	

Semester 6

	Subject	Lectures	Tutorial	Practical	Credits
UE601 Gateway to the professional environment	UE				8 credits
Professional experience Financial	MODULE				
management	MODULE	10.5	9		
Introduction to law	MODULE	15 hours	4.5		
Issues in artificial intelligence	MODULE				
Business-oriented project management techniques	MODULE	6 hours	9		
English (TOEIC level not achieved) S6 Modern languages (TOEIC level achieved)	MODULE		40.5 hours		
	MODULE				
English S6 Modern	SUBJECT				
Language 2	CHOICE		15		
German TD	SUBJECT				
			hours		
			15		
			hours		

Spanish TD	SUBJECT	3:00 p.m.
Italian TD	SUBJECT	3 p.m.

Chinese TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Russian TD	SUBJECT		3 p.m.		
Advanced English S6 Optional internship	SUBJECT		9 p.m.		
S6	MODULE				
Support (every Thursday afternoon when FISA staff are present)	MODULE				
UE602 Instrumentation and project-based learning	UE				8 credits
Electromagnetism and optics applied to information transmission Project-based learning	MODULE	23.5	18	20	
Instrumentation electronics: essential concepts for engineers	MODULE	12	12	12	
	MODULE				
UE603 Information Processing and Automation	UE				10 credits
Signals and Systems	MODULE	12 hours	12 hours	12 hours	
Signals and images: basic operators Mathematics Introduction to Machine Learning	MODULE	13.5 hours	13.5 hours	9 hours	
	MODULE	18	18		
	MODULE	18	6 p.m.		
UE604 Embedded Computing	UE				4 credits
Databases and Web Technologies Embedded Systems I	MODULE		13.5 hours		
	MODULE	9 a.m.	3	24	

IGE4 - Embedded Systems Automation Sensors

Semester 7

	Nature	Lecture	Tutorial	Practical	Credits
UE701 Gateway to the professional environment	UE				6 credits
Resources and professional dynamics Creativity and innovation	MODULE		13.5 hours	3.5	
management English (TOEIC level not achieved) S7 Modern languages	MODULE		25.5		
(TOEIC level achieved)	MODULE		40.5		
English S7 Modern	MODULE				
Language 2	MODULE		15		
German TD Spanish	SUBJECT				
TD Italian TD	CHOICE		15 15		
Chinese TD	SUBJECT		15 15		
Japanese TD	SUBJECT		15 15		
Russian TD	SUBJECT				
Advanced English S7 Optional internship	SUBJECT				
S7	MODULE		21		
Support (half of Thursday afternoons when FISA staff are present)	MODULE				
UE702 Instrumentation	UE				8 credits
Data acquisition systems - Graphical programming Functional materials for instrumentation	MODULE	4.5		32	
	MODULE	21.5	18		
Actuator sizing	MODULE	7.5 hours	4.5 hours	12	

UE703 Information processing and automation	UE				7 credits
Random signals	MODULE	12	12:10:5 hours	12h	
Automatic Control - Stability and Control of Systems Probability - Statistics	MODULE	p.m.	6 p.m.	16h	
	MODULE	10 a.m. 6 p.m.			
UE704 Embedded Computing and Project-Based Learning	UE				9 credits
Networks and Security for Embedded Systems Project-Based Learning	MODULE	25.5 hours		36	
Embedded Systems and Concurrent Programming	MODULE				
	MODULE	9	3	24	

Semester 8

	Nature	Lectures	Tutorial	Practical	Credits
UE801 Gateway to the professional environment	UE				6 credits
Integrated QSE (Quality, Safety, Environment) Management System Management Techniques	MODULE	9am 6pm	10.5		
English (TOEIC level not achieved) S8 Modern Languages (TOEIC level achieved)	MODULE		7.5		
English S8 Modern	MODULE		40.5		
Language 2	MODULE				
German TD Spanish	MODULE		3 p.m.		
TD Italian TD					
Japanese TD	SUBJECT				
Chinese TD Russian			3 p.m.		
TD	CHOICE		3 p.m.		
Advanced English S6 Optional internship			3 p.m.		
S8	SUBJECT		3 p.m.		
Support (half of Thursday afternoons when FISA students are present)			3 p.m.		
	SUBJECT		3 p.m.		
			9 p.m.		
	SUBJECT				
	SUBJECT				
	SUBJECT				
	SUBJECT				
	MODULE				
	MODULE				
UE802 Internship	UE				6 credits
Assistant Engineer Internship S8	MODULE				
UE803 Instrumentation and System Control	EU				10 credits
Decentralized automation	MODULE			24	
Experimental physics, measurements, sensors, and instrumentation	MODULE	16 hours	13.5	hours	
				52	
				hours	
Discrete event system models and applications	MODULE	9	19.5	12	
UE804 Information processing and project-based learning	UE				8 credits
Image Analysis and Computer Vision Project-Based Learning	MODULE	15 hours	13.5	12	
Information Processing Project	MODULE				
	MODULE			24	

IGE5 - Embedded Systems Automation Sensors

Semester 9

	Nature	Lecture	Tutorial	Practical	Credits
UE901 Gateway to the professional environment	UE				10 credits
Research and Development Project English (TOEIC level not achieved) S9 Modern Languages (TOEIC level achieved)	MODULE				
English S9 Modern	MODULE		40.5		
Language 2	MODULE				
German TD	SUBJECT		15		
	CHOICE				
	SUBJECT				
Spanish TD Italian	SUBJECT		15		
TD Japanese TD	SUBJECT		hours		
Chinese TD Russian	SUBJECT		15		
TD	SUBJECT		hours		
Advanced English S9	SUBJECT		15		
Optional internship S9	SUBJECT		hours		
	MODULE		15		
			hours		
			15		
			hours		
			21		
			hours		
UE902 Automation and Project-Based Learning	UE				7 credits
Automatic state approach: representation, control, and observation Project-based learning	MODULE	25.5 hours	25.5	20	
	MODULE				
UE903 Communicating objects	UE				6 credits
Communicating systems, communicating sensors Internet of Things	MODULE			36 24	
	MODULE	3	9		
UE904 Information processing	UE				7 credits
Advanced Machine Learning	MODULE	12		24h	
3D imaging: acquisition, reconstruction, applications Interdisciplinary project: face recognition	MODULE	hours		12h	
	MODULE	13.5	10.5	36h	
		hours			

Semester 10

	Type	Lectures	Tutorial	Practical	Credits
UE001 Engineering Internship	UE				30 credits
Engineering Internship S10	MODULE				

Embedded Systems Automation Sensors - Work-study program

Embedded Systems Automation Sensors Engineering Degree

Presentation Practical information

Campus

Annecy / Annecy-le-Vieux campus

Program

IGE3 - Embedded Systems Automation Sensors - Work-study program

Semester 5

	Nature	Lectures	Tutorial	Practical	Credits
UE501 SHES - Languages	UE				8 credits
Support (every Thursday afternoon) Labor law and corporate structure 1	MODULE				
	MODULE	20 hours	12		
Introduction to sustainable development and CSR - Cognitive development	MODULE	4 p.m.	12 hours	4	
English	MODULE		37 hours		
UE502 Work experience	UE				4 credits
Project 1 (Launch and follow-up) Development in the	MODULE	1		4	
workplace	MODULE				
UE503 Engineering sciences and tools	UE				18 credits
Electricity	MODULE	13.5 hours	15	12	
Skills development support Algorithms and Python programming	MODULE	3	hours		
	MODULE		12	12	
			hours		
			6		
			hours		
Databases (business management information database) Mathematics Core Curriculum	MODULE	6 hours	4.5	12 hours	
Automation	MODULE	16.5	37.5		
	MODULE	hours	13.5		
		6		20	
C programming Material properties	MODULE	6	6:00	12:00	
	MODULE	hours	p.m.	p.m.	
		5 p.m.	9:00	8:00	
			p.m.	p.m.	

Semester 6

	Nature	Lectures	Tutorial	Practical	Credits
UE601 SHES - Languages	UE				4 credits
Introduction to sustainable development and CSR	MODULE	6 hours	4 hours		
Sustainable Development - Site Approach (Environmental Management) Support (every Thursday afternoon when FISA staff are present) English (TOEIC level not achieved)	MODULE	4 hours	6 hours		
English (TOEIC level achieved)	MODULE				
	MODULE				
	MODULE		30		
UE602 Work experience	UE				10 credits
Project 1 (Monitoring and reporting) Development in the	MODULE			4	
workplace (4 areas)	MODULE				
UE603 Engineering Sciences	UE				16 credits
Instrumentation electronics: essential concepts for engineers Embedded systems I	MODULE	12 hours	12h 3h	12h	
Challenges of artificial intelligence	MODULE	9 hours	13.5	24h	
Signals and images: basic operators	MODULE	6 hours		9	
	MODULE	10.5			

Electromagnetism and optics applied to information transmission	MODULE	22 hours	18	20	
Signals and systems	MODULE	12 hours	12	12	

IGE4 - Embedded Systems Automation Sensors - Work-study program (Annecy)

Semester 7

	Nature	Lecture	TD	Practical work	Credits
UE701 SHES - Languages	UE				8 credits
Support (half of Thursday afternoons when FISA staff are present) Management	MODULE				
	MODULE		32		
Business structure and entrepreneurship 2 Sustainable development - Product	MODULE	12	12		
approach English (TOEIC level achieved)	MODULE	hours	hours	8	
English (TOEIC level not achieved)	MODULE	4	2		
	MODULE	hours	hours		
			34		
			hours		
			34		
UE702 Work experience	UE				10 credits
Project 2 (launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				
UE703 Engineering Sciences	UE				12 credits
Random Signals	MODULE	12h 10h	12h 10.5h	12	
Automatic Control - Stability and Control of Systems Functional Materials for Instrumentation	MODULE	21.5h	15	hours	
Data Acquisition Systems - Graphical Programming Embedded Systems and Concurrent Programming	MODULE	4.5		16	
	MODULE	9		hours	
	MODULE		3		
				32	
				hours	
				24	
				hours	

Semester 8

	Nature	Lectures	Tutorial	Practical	Credits
UE801 SHES - Languages	UE				5 credits
Support (half of Thursday afternoons when FISA staff are present) Management and technical communication	MODULE				
	MODULE	6 hours	4	12	
English (TOEIC level not achieved)	MODULE		40 hours		
English (TOEIC level achieved)	MODULE		40		
UE802 Work experience	UE				7 credits
Project 2 (Monitoring and reporting) Development in the	MODULE			8	
workplace (4 areas)	MODULE				
UE803 Engineering Sciences	UE				18 credits
Decentralized Automation	MODULE			24	
Image Analysis and Computer Vision	MODULE	15 hours	13.5		
Experimental physics, measurements, sensors, and instrumentation Networks and security for embedded systems	MODULE	4 p.m.	13.5	32	
Discrete event system models and applications	MODULE	9 p.m.		hours	
	MODULE	9		36	
			19.5	hours	
				12	

IGE5 - Embedded Systems Automation Sensors - Work-study program (Annecy)

Semester 9

	Type	Lectures	Tutorial	Practical	Credits
UE901 SHES - Languages	UE				7 credits
Legislation, labor law, occupational health, sustainable engineering, decarbonization	MODULE	18 hours	8 a.m.	8 a.m.	
GEPC, Humanities, management, ergonomics	MODULE	28 hours			
English (TOEIC level not achieved)	MODULE		26 hours		
English (TOEIC level achieved)	MODULE		26		
UE902 Work experience	UE				10 credits
Project 3 (Launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				
UE903 Engineering Sciences	UE				13 credits
Internet of Things	MODULE	3 hours	9 hours	24	
State-based approach in automation: representation, control, and observation 3D imaging: acquisition, reconstruction, applications	MODULE	25.5 hours	25.5 hours	20 hours	
Advanced Machine Learning	MODULE	10.5	10.5	12 hours	
		12		24 hours	

Semester 10

	Type	Lectures	Tutorial	Practical	Credits
UE001 Work experience	UE				22 credits
Project 3 (Monitoring and reporting) Development in the	MODULE			12	
workplace (4 areas)	MODULE				
UE002 Engineering Sciences	UE				8 credits
Interdisciplinary project: facial recognition	MODULE			36	
Interdisciplinary project: embedded systems and robotics Communication systems, communication sensors	MODULE			hours	
	MODULE			24	
				hours	
				36	
				hours	

IGE4 - Embedded Systems Automation Sensors - Work-study program (Chambéry)

Semester 7

	Nature	Lectures	Tutorial	Practical	Credits
UE701 SHES - Languages	UE				8 credits
Support (half of Thursday afternoons when FISA staff are present) Management	MODULE				
	MODULE		32		
Business structure and entrepreneurship 2 Sustainable development - Product	MODULE	12	12		
approach English (TOEIC level not achieved)	MODULE	hours	hours		
English (TOEIC level achieved)	MODULE	4	2	8	
	MODULE	hours	hours		
			34		
			hours		
			34		

UE702 Work experience	UE				10 credits
Project 2 (launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				
UE703 Engineering Sciences	UE				12 credits
Automatic Control - Stability and Control of Systems Random Signals	MODULE	10 hours	10.5	4 p.m.	
Embedded Systems and Concurrent Programming	MODULE	12 hours	12h 3h	12 p.m.	
Data Acquisition Systems - Graphical Programming EMC	MODULE	9 hours	9	12 a.m.	
	MODULE	4.5 hours		32 hours	2 credits
		9		12 p.m.	

Semester 8

	Type	Lecture	Tutorial	Practical	Credits
UE801 SHES - Languages	UE				5 credits
Support (half of the Thursdays when FISA is present) Management and technical communication	MODULE	6 hours	4	12	
	MODULE				
English (TOEIC level not achieved)	MODULE		40 hours		
English (TOEIC level achieved)	MODULE		40		
UE802 Work experience	UE				7 credits
Project 2 (Monitoring and reporting) Development in the	MODULE			8	
workplace (4 areas)	MODULE				
UE803 Engineering Sciences	UE				18 credits
Experimental physics, measurements, sensors, and instrumentation	MODULE	12	12	24	3.5 credits
FPGA and PSOC	MODULE	21 hours	9h 13.5h	24 hours	5 credits
Image Analysis and Computer Vision	MODULE	15 hours		12 hours	
Networks and security for embedded systems Signal processing processor (DSP)	MODULE	25.5 hours	10.5	36 hours	2.5 credits
		10.5		16	

IGE5 - Embedded Systems Automation Sensors - Work-study program (Chambéry)

Semester 9

	Type	Lecture	Tutorial	Practical	Credits
UE901 SHES - Languages	UE				7 credits
Legislation, labor law, occupational health, sustainable engineering, decarbonization GEPC, Humanities, Management, Ergonomics	MODULE	18 hours	8	8	
	MODULE	28 hours			
English (TOEIC level not achieved)	MODULE		26 hours		
English (TOEIC level achieved)	MODULE		26		
UE902 Work experience	UE				10 credits
Project 3 (Launch and follow-up) Development in the	MODULE	1		8	
workplace (progress)	MODULE				

UE903 Engineering Sciences	UE				13 credits
Low-power communication systems Real-time operating systems and Linux kernel for embedded systems Advanced machine learning Communication Bus Implementation of 32-bit microcontrollers	MODULE MODULE MODULE MODULE MODULE	8 hours 20 hours 12 hours 9 hours 3 hours	9	20h 28h 24h 20h 24h	2 credits 3.5 credits 2.5 credits 2.5 credits

Semester 10

	Nature	Lecture	Tutorial	Practical	Credits
UE001 Work experience	UE				22 credits
Project 3 (Monitoring and reporting) Development in the workplace (4 areas)	MODULE MODULE			12	
UE002	UE				8 credits
Interdisciplinary project: Embedded AI	MODULE			36 24	
Interdisciplinary project: Embedded systems and robotics Internet of Things	MODULE MODULE	3	9		

UE501 Bridge to the professional world

ECTS
8 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
English S5 Sports	MODULE		40.5 hours		
Business management simulation	MODULE		21 hours		
Skills development support	MODULE		1.5 hours		
	MODULE	3 hours	12		

	Nature	CM	Tutorial	Practical	Credits
Optional internship S5	MODULE				
Support (every Thursday afternoon)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

English S5 (LANG501_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English

Teaching methods: Hybrid **Teaching format:** Tutorials **Open to exchange students:** Yes **ERASMUS reference:** Languages

Presentation

Description

This course prepares students for the TOEIC ("Test of English for International Communication") exam, specifically to achieve a minimum score of 785 points (out of 990).

With the aim of developing all four skills, this course also serves as an introduction to public speaking through presentations given by students in groups or individually on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate, as well as written work). Depending on the location (Annecy or Chambéry), some will be seen at different times during the semester, the year, or even the three years of training.

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam, depending on the semester, and counts for 20% of the total continuous assessment.

Objectives

Specific objectives: at the end of this course, students will be able to:

revise grammar on: the correct reflexes of common structures; the verb group and tenses (except the conditional tense); the noun group and all its constituent elements; logical links (connecting words)

improve their grammatical and lexical knowledge (general English and TOEIC-specific vocabulary) in class and independently, validating their progress through regular assessment tests.

Teaching hours

Tutorials	Tutorials	40.5

Mandatory prerequisites

CEFR level B1

Course outline

1. **Oral**
   1. Elements of phonology
   2. Grammar (tenses, questions, adjectives.....)
   3. Reinforcement of structures and vocabulary
   4. Interactive oral communication
   5. Introduction to and practice for the TOEIC (listening section)
2. **Writing**
   1. Review of grammatical elements (tenses, questioning, adjectives. .....)
   2. Translation (theme/version)
   3. Reading comprehension in authentic language
   4. Curriculum vitae (in S5, S6, or S7 at the latest)
   5. Cover letter/letter of motivation (in S5, S6, or S7 at the latest)
   6. Introduction and training for the TOEIC (reading section)

Bibliography

- Documents distributed by lecturers
- Various websites, a list of which is provided at the beginning of the year
- Global Exam

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Sport (SHES501_PACY)

Polytech Annecy-Chambéry
component

In brief

Course start date: Sept. 8, 2025 **Languages of instruction:** French
Teaching methods: In person **Teaching format:** Tutorials **Open to exchange students:** Yes
ERASMUS reference: Services to individuals

Presentation

Description

This course focuses on physical and sports activities and is structured around two main areas.

On the other hand, the aim is to enable engineering students to acquire collective skills in project implementation and group management, but also to develop their individual abilities to adapt and regulate themselves. This focus will be reflected in the collective organization and implementation of a sporting event over the course of one session.

It also aims to enable students to acquire skills related to sporting activities and to highlight their interpersonal skills, which are essential for their integration and professional success. This focus will be based on the work carried out around the values conveyed by the various sporting activities and their diverse modes of practice.

Objectives

Objective 1: Work as a team to prepare, organize, and manage a sporting event within a constrained framework.

Objective 2: Engage in a new physical activity in an intense, lucid, reasoned, and critical manner

Teaching hours

Tutorials	Tutorials	21

Mandatory prerequisites

No mandatory prerequisites

Course outline

7 three-hour practical sessions.

Additional information

Classes are held at the Dassault gymnasium, avenue des îles in Metz-Tessy. Bus transportation (round trip) is provided from the Annecy campus.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Jean-Baptiste Evrot
+33 4 50 09 24 35
Jean-Baptiste.Evrot@univ-savoie.fr

Course coordinator Vincent Daniere
+33 4 50 09 24 35
Vincent.Daniere@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Business Management Simulation (SHES505_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** Hybrid
Teaching format: Tutorials **Open to exchange students:** Yes

Presentation

Description

Business games, also known as serious games or business management simulations, are educational tools that offer a different way of learning. They are simulations that aim to demonstrate the complexity of businesses while relying on a simplified model. In a business game, time is accelerated and participants play out several years in the life of a company over a condensed period (two days in this case). This business simulation is carried out using a computer program. The program incorporates an algorithm to calculate the performance of each competing team (each team representing a company in the market) at the end of each decision.

Objectives

1. Analyze the general context to communicate more effectively.
2. Learn about the main communication tools, media/non-media,
3. Understand the process of developing a communication strategy,
4. Provide comprehensive, practical, and effective training in business management,
5. Raise awareness of the interdependence of business functions through decision-making and results analysis.

Teaching hours

Tutorials	Tutorials	1.5
Distance	Distance learning	18

Mandatory prerequisites

None

Course outline

Focused on a cross-functional approach to business management issues, this game combines various constraints specific to different business functions (marketing, production, finance, and financial resources) and allows students to learn the basics of both oral and written communication. Through simulation, students will address person-to-person, face-to-face communication. External communication mainly involves communication for the purposes of corporate marketing: strategy development, overview of tools, etc.

Targeted skills

- Be able to design the basics of a business strategy.
- Know how to support the development and implementation of a communication plan,
- Be able to work in a team,
- Know how to communicate and make decisions as part of a team

Bibliography

- Sophie Delerm, Jean-Pierre Helfer, and Jacques Orsoni. "Les bases du marketing" (The Basics of Marketing), Vuibert, 2006 (Part 2, Chapters 1 and 2, and Part 3, Chapter 2).
- Jacques Lendrevie, Julien Levy, "Mercator, Theory and New Practices in Marketing (9th Edition)," Dunod, Paris, 2009 (Chapter 15)
- Jean Barreau, Jacqueline Delahaye, "Financial Management DECF Test 4," Dunod, 2006 (Chapters 7 and 8)
- Christian Goujet, Christian Raulet & Christiane Raulet, "Management Accounting," Dunod, Paris, 2007. (Chapters 1, 17, and 18)
- Maurice Pillet, Chantal Martin-Bonnefous, Pascal Bonnefous, Alain Courtois, "Production Management: Fundamentals and Best Practices," Eyrolles, 2011. (Read: Chapters 4, 6, and 8)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Elodie Gardet
+33 4 50 09 24 51
Elodie.Gardet@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Skills Development Support (ADCO501_PACY)

Polytech Annecy-Chambéry component

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

Presentation

Description

As the school is committed to a skills-based approach, this course aims to introduce students to this approach, familiarize them with the skills framework for their training, and present them with the various documents and tools they will need to use throughout their training.

Teaching hours

CM	Lecture	3
Tutorial	Tutorials	12

Course outline

Content elements for all specializations

- Understanding the APC approach and its relevance to engineering education (link to professions, RNCP)
- Understanding the main concepts and learning the terminology used by the school
- Find resources related to APC (reference documents, RNCP files, cross-referenced matrices, AMS mapping, portfolio, etc.)

- Reading a training reference document (templates and examples)
- Understanding what a portfolio is
- Write a skills assessment (KAPC+ example)

Specific content elements for each specialty

- Get to grips with the reference framework for your specialty
- Link the reference guide to job characteristics
- Assessing your position in your training program
- Identify the contribution of resources to the skills in the reference framework (cross-referenced matrices)
- Identify the situational activities (AMS) in your training and the skills they involve
- Use the portfolio to self-assess the skills in your training program

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Ilham Alloui

+33 4 50 09 65 87

Ilham.Alloui@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Optional internship S5 (PROJ500_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The optional internship aims to enrich students' academic and professional experience by offering them a practical opportunity to apply their knowledge and acquire new skills. An optional internship can be carried out **in France or abroad**. It must comply with the same general conditions as compulsory internships.

Objectives

- **Acquisition of** specific skills related to the specialization;
- **Refining career goals and/or** gaining confidence and independence through the completion of a project or specific tasks;
- Establish valuable professional contacts that can help in future job searches.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Head of the Polytech Business Relations course

Relations-Entreprises.Polytech@univ-savoie.fr

Support (every Thursday afternoon) (ACCO501_PACY)

Polytech Annecy-Chambéry

In brief

Teaching methods: In person **Teaching format:** Tutored project **Open to exchange students:** Yes

Presentation

Description

This support is open to all students at the school: students, apprentices, and Continuing Education employees. It is not mandatory, as it is primarily intended for students who need it to succeed in their training. This semester, it is scheduled into the timetable for each course, with a total of 64 hours.

Support may take the form of refresher courses, upgrading courses, or support in the main areas of the training programs.

Peer tutoring is encouraged and the educational resources of the Polytech Network are used (https://eplanet.polytech-reseau.org/).

Objectives

To promote the success of all students in their educational journey.

Teaching hours

PTUT	Tutored project	64

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Director of Polytech Training

Locations

Annecy-le-Vieux (74)

UE502 Engineering Sciences and Tools

ECTS
9 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Sustainable Development	MODULE	3 p.m.	12 hours		
Algorithms and Python Programming	MODULE	3 hours	6 hours	12 hours	
Databases (business management information database) MAraTHon: Support/Refresher courses	MODULE	6	4.5	12	
Mathematics Core Curriculum	MODULE				
	MODULE				
		16.5	37.5		

Practical information

Locations

Annecy-le-Vieux (74)

Sustainable Development (DDRS501_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

ERASMUS reference: Engineering and related techniques

Overview

Description

This course trains engineering students in the issues of sustainable development and its integration into businesses. The aim is to enable them to consider and integrate the challenges of ecological and energy transition into their professional work.

Objectives

Students will learn to define the various challenges of ecological and societal transition, as well as energy issues. They will be introduced to the tools available to engineers to limit the ecological impact of a product or service.

Teaching hours

Lectures	Lecture	15
Tutorial	Tutorials	12

Course outline

1. Introduction to sustainable development (3 hours of lectures)

1. 1. Planetary boundaries
    2. Concept of sustainable development and ecological and societal transition
2. Carbon footprint (3 hours of lectures)
    1. The concept of climate
    2. Climate change - Greenhouse gases
    3. Carbon footprint method (6 hours of tutorials)
3. Energy (3 hours of lectures)
    1. Concepts of power and energy
    2. Global energy situation
    3. Practical exercises and case studies (3 hours of tutorials)
4. The ecological transition in business (1.5 hours lecture)
5. Product life cycle analysis, eco-design (3 hours of lectures, 3 hours of tutorials)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator David Gibus
+33 4 50 09 65 77
David.Gibus@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Algorithms and Python Programming (INFO501_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Information and Communication Technologies (ICT)

Overview

Description

This is an introductory course on the use of programming to solve problems related to engineering. It will introduce concepts of algorithms and data representation in a computer. In practice, students will also learn to program in Python for the MM track and C for the IDU/SNI tracks.

Objectives

This course aims to provide students with basic knowledge of how information is represented in computers, while also introducing them to traditional data structures. The module also aims to teach students the basics of algorithms and programming. The goal is to enable students to use IT tools to solve problems encountered in engineering.

Teaching hours

Lectures	Lecture	3
Tutorial	Tutorials	6
Lab	Practical work	12

Mandatory prerequisites

None

Course outline

The course is divided into:

- Lectures (CMs), where concepts related to algorithms and data structures will be introduced
- Tutorials (TDs), where concrete examples will be put into practice in a programming language
- Practical work (PW) where we will explore concepts and skills in depth to solve concrete problems. The program is as follows:

1. Machine architecture and basic data representations
2. Algorithmic concepts and introduction to C programming
    1. Language basics
    2. Control structures
    3. Loops
    4. Functions and procedures
    5. Compilation
3. Data structures and implementation in C language
    1. Structs
    2. Linked lists
    3. Graphs and trees
4. Complex algorithms
    1. Sorting and selection
    2. Graph traversal
    3. Hashing
5. Concept of algorithmic complexity
6. Use of a high-level language: the case of Python

In MM courses:

1. Machine architecture, data representation
2. Introduction to Python programming
    1. The basics of the language
    2. Basics of the language
    3. Control structures

4. Loops
5. Functions and procedures
6. Classic data structures

3. Algorithmic concepts and implementation in Python
   1. Calculation of mathematical functions
   2. Sorting and selection
4. Object-oriented programming
5. Problem solving using libraries

Targeted skills

At the end of this module, students should be able to:

- model a concrete problem using an appropriate data structure
- solve the problem by implementing an algorithmic approach
- program the solution on a computer

Bibliography

- Learning to Program with Python 3, Gérard Swinnen
- C Programming Language Kernighan Brian, Ritchie Dennis

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course Director Ammar Mian
+33 4 79 75 85 85
Ammar.Mian@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Databases (business management information database) (INFO502_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Information and Communication Technologies (ICT)

Overview

Description

This course aims to provide students with the basic skills needed to model, implement, and manipulate a relational database. The course focuses on general and business-related problems.

Objectives

1. Designing a simple relational database (< 10 entities, linked only by 1-n or n-m links)
2. Implementing a simple database in a relational DBMS
3. Using a relational database with simple queries

Teaching hours

Lectures	Lecture	6
Tutorial	Tutorials	4.5
Lab	Practical work	12

Mandatory prerequisites

None

Course outline

1. Introduction to Databases (30 min CM 1)
2. Entity/Association (EA) modeling in UML standard (1 hour CM 1)
3. Relational modeling & transition from EA to relational modeling (1.5 hours, lecture 2)
    1. Tutorial 1: EA and relational models
4. Relational Algebra (1.5 hours, Lecture 2)
    1. Tutorial 2: Relational algebra
    2. Tutorial 3: Extended relational algebra
    3. Lab 1: Manipulating a database in SQL
    4. Lab 2: Modifying a database in SQL
    5. Lab 3: Database lab exam in SQL

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Flavien Vernier

+33 4 50 09 65 90

Flavien.Vernier@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

MAraTHon: Support/Refresher Course (MATH500_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

ERASMUS reference: Mathematics and statistics

Presentation

Description

This course aims to strengthen students' foundations in mathematics.

Teaching hours

PTUT	Tutored project	15

Course outline

1. Plane geometry and geometry in space
2. Complex numbers, polynomials, rational fractions: decomposition into simple elements on R
3. Linear systems, matrices, determinants
4. Differential calculus of functions of a real variable, applications: Taylor's formula, limited developments, equivalents
5. Basic integral calculus (including change of variable), definition and examples of generalized integrals
6. Basic differential equations: first-order linear cases, variation of the constant, second-order linear equations with constant coefficients.

Bibliography

- J-P. Truc, Précis de Mathématiques, Nathan, 1997
- G Chauvat, A. Chollet, Y.Bouteiller, Mathématiques, Ediscience, 2005
- S Ferrigno, D Marx, A Muller-Gueudin, Mathématiques pour les sciences de l'ingénieur, Dunod, 2013

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Catherine Adloff

+33 4 50 09 66 43

Catherine.Adloff@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Mathematics Core Curriculum (MATH501_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French **Teaching methods:** In-person

Open to exchange students: Yes

ERASMUS reference: Mathematics and statistics

Presentation

Description

This course aims to provide the fundamentals of analysis necessary for engineering sciences.

Teaching hours

Lectures		Lecture	16.5
Tutorial		Tutorials	37.5

Mandatory prerequisites

MATH500: Mathematics refresher course or otherwise solid foundation in mathematics equivalent to two years of postsecondary education

Course outline

1. Differential calculus: functions of several variables, differentiation, examples of partial differential equations
2. Vector analysis (Part 1): differential operators, scalar potentials, vector potentials,
3. Curves and surfaces, point motions

4. Multiple integrals

5. Vector analysis (Part 2): line integrals, surface integrals

Bibliography

Books:

- J-P. Truc, Précis de Mathématiques, Nathan, 1997 (for MATH500)
- J. Stewart, Analysis, Concepts and Contexts, vol. 2, De Boeck, 2001
- B. Dacorogna, Advanced Analysis for Engineers, Presses polytechniques et universitaires romandes, 2002
- E. Azoulay, J. Avignant, G. Auliac. Mathematics in the Bachelor's Degree (2nd year, volume 1), Ediscience, 2003
- F. Cottet-Emard, Analysis 2, De Boeck, 2006
- P. Pilibossian, J-P. Lecoutre, Analysis, 1998
- P. Pilibossian, J-P. Lecoutre, Algebra, 1998
- P. Thuillier, J.C. Belloc, Mathematics (2 volumes), 2004 Websites:
- https://fr.wikiversity.org/wiki/Facult%C3%A9:Math%C3%A9matiques
- https://uel.unisciel.fr/uel/co/Uel.html

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Catherine Adloff

+33 4 50 09 66 43

Catherine.Adloff@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE503 Engineering Sciences

ECTS
13 credits

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Automation	MODULE	6	13.5	20	
Experimental discovery of the SNI specialty C programming	MODULE			hours	
	MODULE			40	
		6	6	hours	
				12	
Material properties	MODULE	5 p.m.	9:00	8	
Electricity	MODULE	13.5 hours	3 p.m.	12 hours	

Practical information

Locations

Annecy-le-Vieux (74)

Automation (EASI541_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Presentation

Description

From production lines to energy management in homes, automated systems are numerous and varied. This course covers the basic elements necessary for modeling, analyzing, controlling, and implementing automated systems in a centralized solution context (as opposed to a distributed solution that would rely on task distribution but be coordinated by communication networks).

Objectives

Upon completion of this course, students will be able to:

- propose an automated system architecture, highlighting the instrumentation, control, and human/machine interface
- model the functional, technological, and operational specifications for controlling an automated system, based on the description of its specifications
- organize the control solution for a centralized automation system, adopting modular operating modes and process hierarchy

Teaching hours

Lectures	Lecture	6
Tutorial	Tutorials	13.5
Lab	Practical work	20

Mandatory prerequisites

Basic knowledge of Boolean algebra

Course outline

1. System operating modes (GEMMA) and human-machine interface (HMI)
2. Combinatorial issues
    1. Establishing solutions
    2. Canonical representations
    3. Simplification methods
    4. Simplified notation
3. Grafcet: a tool for specifying and modeling sequential problems
    1. General principles: concepts, graphic elements, interpretation
    2. Evolution rules
    3. Basic structures: sequence, choice, parallelism, synchronization
    4. Horizontal and vertical structuring: derived structures, resources
    5. Interpretation algorithm
4. Automation project management: an example of design methodology
    1. Hierarchization and cooperation of models
    2. Variable naming rules
    3. Application to programming with Unity-Pro

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Stephane Marteau
+33 4 50 09 66 03
Stephane.Marteau@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Experimental discovery of the SNI specialty (PROJ541_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Teaching format: Practical work **Open to exchange students:** Yes
ERASMUS reference: Engineering and related techniques

Presentation

Description

This module aims to provide an experimental introduction to various aspects of the SNI specialty. It consists of five practical sessions, each lasting eight hours.

The five topics covered are:

- computer science and service robotics;
- image analysis and computer vision;
- acquisition and use of data from sensors
- automation and control systems;
- control of embedded system motors.

Objectives

To enable students to discover, through experimentation, key topics in the SNI specialization, which they will have the opportunity to explore in greater depth during the rest of their engineering studies.

Teaching hours

Practical	Practical work	40

Mandatory prerequisites

None

Course outline

The module consists of five practical sessions, each lasting eight hours. The five topics covered are:

- Introduction to service robotics

Through the graphic programming of humanoid robots, the work consists of developing behaviors so that robots can interact with humans. Following an initial introduction to robots and their programming, a specific project is developed in groups of three in order to put into practice the concepts learned in the first part. The session ends with the development of a specific behavior.

- Image analysis and computer vision

Images are increasingly used in many fields: autonomous vehicles, robotics, medical imaging, earth observation, quality control, surveillance systems, etc. Taken from different angles, images enable 3D reconstruction of the scenes observed, while time series allow changes to be detected or movements to be measured. The aim of this theme is to discover the potential of images as sources of information. Using three series of images acquired in a parking lot, the aim is to discover the structure of these data and the basic image processing tools used to manipulate them. These series of images are then used to discover stereo vision, change detection, and vehicle trajectory measurement.

- Acquisition and use of data from sensors: A scale for assessing posture and balance

Everyone has, or can easily obtain, a bathroom scale at home. Its main function is to indicate a person's weight while standing. But how does it work? On what principle(s)? Is it possible to use it in the context of stabilometry to observe how the subject "manages" to stabilize themselves while standing? A statokinesigram provides a clear and effective representation of a person's stability measurement. It displays the movement of the center of pressure

of the feet in the plane of the scale. This topic focuses on capturing/measuring, retrieving information, and plotting results.

- Modeling and control of a LEGO MINDSTORMS EV3 target-tracking robot

This topic falls within the field of automation. The objective of the proposed work is to achieve position control of the robot relative to a moving target, using MATLAB and SIMULINK software.

- Controlling the motors of a 2-wheel drive robot

The objective of this topic is to control the movement of a two-wheel drive robot so that it follows a given path. To do this, it is necessary to accurately characterize the robot's two gear motors. Each gear motor is powered by a speed controller. The two controllers are controlled by an ARDUINO UNO board.

Additional information

None.

Bibliography

None.

Skills

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal Mouille
+33 4 50 09 65 81
Pascal.Mouille@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

C Programming (INFO503_PACY)

Polytech Annecy-Chambéry
component

Presentation

Description

This C programming course, designed as a follow-up to the Python course, aims to deepen understanding of low-level machine mechanisms (binary representation and memory management), master the syntax and semantics of the C language, manage dynamic allocation, implement fundamental data structures (linked lists), and develop efficient sorting and search algorithms. It consists of 6 hours of lectures, 6 hours of tutorials, and 12 hours of practical work.

Objectives

By the end of this course, students should be able to:

- **Understand** the binary representation of data and its organization in memory.
- **Master** the basic syntax of the C language: types, operators, control structures, and input/output management.
- **Use** pointers to manipulate addresses and perform pointer arithmetic.
- **Implement** dynamic memory allocation with malloc, calloc, realloc, and free, and detect memory leaks.
- **Implement** and manipulate fundamental data structures, in particular simple linked lists.
- **Design**, code, and analyze the complexity of sorting algorithms (e.g., bubble sort, insertion sort, quick sort) and search algorithms (linear and binary).

Teaching hours

Lectures	Lecture	6
Tutorial	Tutorials	6
Lab	Practical work	12

Mandatory prerequisites

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Ammar Mian
+33 4 79 75 85 85
Ammar.Mian@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Properties of Materials (PACI541_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person **Open to exchange students:** Yes **ERASMUS reference:** Physical sciences

Presentation

Description

The course begins with general concepts on the structure of materials, then moves on to models describing their electrical, thermal, and mechanical properties. It also covers concepts related to heat transfer between materials.

Objectives

The general objective of this course is to provide the resources necessary to understand the properties of materials for use in instrumented systems (sensors, actuators, structures, etc.). Thus, the objectives are to:

1. describe the internal structure of materials,
2. associate certain properties of materials with their composition
3. distinguish between different classes of materials based on their electrical properties with a view to their use (e.g., sensor or actuator)
4. distinguish between different classes of materials based on their thermal properties
5. model heat transfer between materials in a simple configuration
6. compare the mechanical behavior of different classes of materials.

This course also aims to provide the necessary foundations for studying materials with specific properties (electrical or magnetic) used in instrumentation.

Teaching hours

Lectures	Lecture	5 p.m.
TD	Tutorials	9 a.m.
Lab	Practical Work	8

Mandatory prerequisites

Fundamentals of Physics

Course outline

1. Structure of materials

1.1 Atomic bonds
1.2 Crystalline structure
1.3 Amorphous materials

2. Electrical properties

2.1 Charge carriers and electrical conduction
2.2 Energy levels and bands
2.3 Electrical conductors and applications
2.4 Electrical insulators and applications
2.5 Semiconductors and applications
2.6 Classification of materials

3. Thermal properties and transfers

3.1 Thermal properties of materials
3.2 Introduction to heat transfer
3.3 Heat transfer by conduction
3.4 Heat transfer by convection
3.5 Heat transfer by radiation
3.6 Electrical analogy, thermal resistances, and analogous electrical networks

4. Mechanical properties

4.1 Stress and strain (metals, ceramics and glass, polymers)
4.2 Elastic deformation
4.3 Plastic deformation
4.4 Hardness
4.5 Stress and strain (metals, ceramics and glass, polymers)

Practical work:
Convection, conduction, radiation: experimentation and modeling Crystallography: visualization of structures using Diamond software

Bibliography

James F. Schackelford, *Introduction to Materials Science for Engineers*, Pearson Prentice Hall, 2000

Dissemination of IT for the Promotion of Materials Science (DoITPoMS) / University of Cambridge

Online resources from the University of Le Mans: "Physics and simulation." Category: "Crystallography"

F. P. Incropera, D. P. DeWitt, and T. L. Bergman, *Fundamentals of Heat and Mass Transfer.* Hoboken, NJ, USA: John Wiley & Sons, 2007.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Yannick Mugnier
+33 4 50 09 65 16
Yannick.Mugnier@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Electricity (EASI501_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

Presentation

Description

Fundamentals of electricity, study of transient, continuous, and sinusoidal regimes

Objectives

- Calculate and measure electrical quantities such as currents and voltages in a linear circuit, in steady state, transient state, single-phase sinusoidal or three-phase sinusoidal conditions.
- Calculate and measure the power and energy consumed in a linear circuit, in continuous, transient, single-phase sinusoidal, or three-phase sinusoidal conditions.
- Explain the operating principle of a direct current motor.
- Describe the general architecture of the electricity production, distribution, and consumption network in France.
- Determine whether a simple electrical installation (domestic or small business) presents an electrical hazard.

Teaching hours

Lectures	Lecture	13.5
Tutorial	Tutorials	15
Lab	Practical work	12

Mandatory prerequisites

Scientific and technological knowledge from the first cycle of university studies

Course outline

Part 1: Continuous and transient circuits

A/ General laws of electrokinetics: Kirchhoff's laws, operating laws applied to basic dipoles
B/ Study of steady state - General theorems: Thévenin's theorem, Norton's theorem, superposition theorem, Millman's theorem C/ Study of transient states
D/ Electromechanical conversion – DC motor

Part 2: Single-phase and three-phase circuits - Electrical energy and protection

E/ Sinusoidal quantities and complex notation
F/ Linear circuits in single-phase sinusoidal operation: active, reactive, and apparent power G/ Production, transmission, and consumption of electrical energy
H/ Three-phase sinusoidal system
I/ Ground connection diagram – electrical protection

Bibliography

- Electrical Engineering Handbook, lectures and corrected exercises by Christophe Palermo, published by Dunod
- General Electricity: Circuit Analysis and Synthesis, lectures and corrected exercises by Tahar Neffati, published by Dunod
- Electricity Manual, Course Essentials and Corrected Exercises by Christophe Palermo & Jérémie Torres, published by Dunod

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Francois Leplus

+33 4 50 09 66 20

Francois.Leplus@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE601 Bridge to the professional world

ECTS
8 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Professional experience	MODULE				
Financial management	MODULE	10.5 hours	9		
Introduction to law	MODULE	15 hours	4.5		
Issues in artificial intelligence	MODULE	6			
Business-oriented project management techniques	MODULE		9		

	Nature	Lecture	Tutorial	Practical	Credits
English (TOEIC level not achieved) S6	MODULE		40.5		
Modern languages (TOEIC level achieved)	MODULE				
English S6 Modern Language 2	SUBJECT		3 p.m.		
German TD	CHOICE		3 p.m.		
	SUBJECT				
Spanish TD Italian	SUBJECT		3 p.m.		
TD Chinese TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Russian TD	SUBJECT		3 p.m.		
Advanced English S6	SUBJECT		3 p.m.		
	SUBJECT		9 p.m.		

	Nature	CM	Tutorial	Practical	Credits
Optional internship S6	MODULE				
Support (every Thursday afternoon when FISA staff are present)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Professional experience (PROJ601_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The "worker" professional experience allows students to discover the practical aspects of blue-collar work and to understand the hierarchies, methods, and techniques used in companies. This experience should preferably take place in an industrial or construction company related to the student's area of expertise and likely to hire engineers. Teleworking is not permitted.

Objectives

- Gain experience in a professional environment as an operator (worker, unskilled person, etc.);
- Integrate into and participate in a professional organization;
- Observe how the company operates;
- Identify the roles of employees (engineers, technicians, workers, etc.);
- Analyze working conditions, risks, and organization;
- Reflect on sustainable development and social/environmental responsibility;
- Draw conclusions from the internship for your own training, career plans, and management methods.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course Director, Polytech Business Relations
Relations-Entreprises.Polytech@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Financial Management (SHES601_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In-person
Open to exchange students: Yes
ERASMUS reference: Business and administration

Overview

Description

This course aims to familiarize students with the fundamental principles of financial management and corporate finance. It is structured in such a way as to facilitate understanding of the interactions between key concepts, practical tools, and key players, with a view to rapid and effective application in a professional context.

Objectives

- Understand the key concepts of entrepreneurship and business start-ups/takeovers.
- Acquire the skills necessary to develop a business strategy.
- Explore financing and growth strategies for businesses.
- Develop an understanding of the challenges and opportunities faced by entrepreneurs.

Teaching hours

Lectures		Lecture	10.5
Tutorial		Tutorials	9

Mandatory prerequisites

None

Course outline

The main topics covered are:

- The fundamentals of financial accounting
- Interpretation of financial statements (income statement, statement of changes in equity, balance sheet, cash flow statement, etc.)
- Sources of short- and long-term financing, both on and off balance sheet, as well as stakeholders, financial structures, etc.
- Key players in the financing process (banks, venture capital/private equity, etc.)
- Aspects related to valuation and exit scenarios
- The correlation between strategy and financial control, as well as the role of the business plan
- Cost and revenue analysis techniques
- Designing a performance management system (indicators, dashboard, financial and non-financial criteria, etc.)

Targeted skills

- Understanding key points in a company's financial statements, knowing how to look at a balance sheet from a financing perspective, analyzing a company's situation
- Knowing how to build an economic performance management system.
- Understanding the different sources of financing and their impact on capital structure.
- Ability to identify and manage financial risks in a technological context.

Bibliography

Brealey, Richard A., and Stewart C. Myers. *Principles of Corporate Finance*. New York, McGraw-Hill Education, 2017.

Ross, Stephen A., Randolph W. Westerfield, and Bradford D. Jordan. *Corporate Finance*. New York, McGraw-Hill Education, 2018. Brigham, Eugene F., and Michael C. Ehrhardt. *Financial Management: Theory & Practice*. Mason, Cengage Learning, 2017.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Elodie Gardet
+33 4 50 09 24 51
Elodie.Gardet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Introduction to Law (SHES602_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes **ERASMUS reference:** Law

Presentation

Description

This introductory course in law aims to familiarize students with fundamental legal concepts. It explores the basic principles of law, with an emphasis on legal aspects related to the practice of engineering, such as contracts, civil liability, intellectual property, and industrial regulations.

Objectives

- Understand the general principles of law
- Acquire the knowledge necessary to interpret and draft contracts related to engineering projects.
- Explore the concepts of civil liability and intellectual property protection in the context of technology projects.
- Develop legal and ethical awareness in engineering practice.

Teaching hours

Lectures		Lecture	15
Tutorial		Tutorials	4.5

Mandatory prerequisites

none

Course outline

1. Judicial Institutions, Fundamental Principles, and Key Players in the Justice System
2. Criminal Procedure and Criminal Law
3. Contracts, Contractual Liability, and Intellectual Property Rights
4. Labor Law

Targeted skills

- Ability to understand and apply fundamental legal principles
- Ability to analyze the legal implications of decisions and actions in a professional context.
- Skills in interpreting engineering contracts.
- Knowledge of civil liability and intellectual property concepts related to engineering.

Bibliography

J.-B. Blaise and R. Desgorces, Business Law, 8th ed., LGDJ, 2015.

F. Dekeuwer-Défossez and E. Blary-Clément, Commercial Law, 11th ed., Montchrestien, 2015.

P. and Ph. Didier, Commercial Law, vol. I, Economica, coll. "Corpus droit privé," 2005.

D. Houtcieff, Commercial Law, 4th ed., Sirey, 2016.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Elodie Gardet
+33 4 50 09 24 51
Elodie.Gardet@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Issues in Artificial Intelligence (DATA601_PACY)

Polytech Annecy-Chambéry
component

Presentation

Description

In the era of large language models, it is no longer enough to know how to use a chatbot: it is crucial to understand the underlying mechanisms in order to discern where AI brings real value and where it reaches its limits. As future engineers and citizens, engineering students will be called upon to observe the profound impact of these technologies on society—transforming professions, redefining social interactions, and disrupting decision-making processes. At the same time, the massive emergence of AI-dedicated computing centers raises major environmental issues: the energy consumption and carbon footprint of model training continue to grow and call for responsible technical and organizational choices. Finally, behind every AI application lie ethical challenges: copyright protection, privacy, and prevention of malicious use are all issues that require critical and informed consideration.

Objectives

By the end of the module, students will be able to:

- Describe the basic functioning of a neural network (perceptron, backpropagation) and explain the role of attention in a transformer.
- Explain what a language model is and give concrete examples of applications.
- Identify at least three types of bias in LLMs and propose a simple method for detecting them.
- Estimate the energy impact of an LLM model and list two best practices for reducing it (choice of infrastructure, work splitting).
- Write and test a clear prompt to generate useful text (summary, code, explanations).
- Recognize copyright and privacy issues related to the use of an LLM.

Teaching hours

Lectures	Lecture	6
AUTO	Independent study	4
PROJ	Project	10

Mandatory prerequisites

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course leader Ammar Mian

+33 4 79 75 85 85
Ammar.Mian@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Business-oriented project management techniques (PROJ602_PACY)

Polytech Annecy-Chambéry
component

Presentation

Description

Project management requires methods and techniques that all engineers must know. However, depending on the profession, the stages and tools used to manage a project may differ. This course is differentiated according to the program.
With the help of the Corporate Relations Department and the Business Club, stakeholders from the socio-economic world come to present their daily experiences and how they evolve in project mode to control objectives, deadlines, costs, and associated resources.

Objectives

Acquire a project management methodology
Understand the necessary relationships between all project stakeholders Master the stages and tools of project management

Teaching hours

Tutorials	Tutorials	9

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Director of Training, Polytech

Locations

Annecy-le-Vieux (74)

Le Bourget-du-Lac (73)

English (TOEIC level not achieved) S6 (LANG601_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Mathematics and statistics

Presentation

Description

This course prepares students for the TOEIC test ("Test of English for International Communication") and, more specifically, for obtaining a minimum score of 785 points (out of 990).

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam, depending on the semester, and counts for 20% of the total continuous assessment.

Objectives

Specific objectives: at the end of this course, students will be able to:

review grammar on: correct reflexes for common structures; verb groups and tenses (except for the conditional tense); noun groups and all their constituent elements; logical links (connecting words)

improve their grammatical and lexical knowledge (general English and TOEIC-specific vocabulary) in class and independently, validating their progress through regular assessment tests

Teaching hours

Tutorials	Tutorials	40.5

Mandatory prerequisites

S5 program (LANG501)

Course outline

Course outline

1. **Review of important grammar points for the TOEIC**
   1. Nouns
   2. Pronouns
   3. Linking words...
2. **Listening comprehension**
   1. Recorded dialogues in American, British, and New Zealand English...
   2. Videos in American, British, and Australian English...
3. **Reading comprehension**
   1. Press excerpts
   2. Various texts

Bibliography

Documents provided by lecturers Global Exam

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern Languages (TOEIC Level Achieved) (LANG602_PACY)

Polytech Annecy-Chambéry

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
English S6	SUBJECT		3 p.m.		
Modern Language 2	CHOICE				
German TD Spanish	SUBJECT		3:00		
TD Italian TD	SUBJECT		p.m.		
Chinese TD	SUBJECT		3:00		
Japanese TD	SUBJECT		p.m.		
Russian TD	SUBJECT		3:00		
Advanced English S6	SUBJECT		p.m.		
	SUBJECT		3:00		
	SUBJECT		p.m.		
	SUBJECT		3:00		
			p.m.		
			3:00		
			p.m.		
			9:00		
			p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

English S6 (LANG602_PACYM1)

Polytech Annecy-Chambéry

Time of year Spring

In brief

Languages of instruction: English, French **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Capacity: 25 per group

Presentation

Description

This course is an introduction to professional English.

Students will work on their fluency in the five skills (group project).

Students will develop their skills through the study of specific topics and/or develop their intercultural knowledge.

Students will be assessed throughout the semester.

Objectives

The objective is to improve students' autonomy in the English-speaking workplace by developing their reading and listening comprehension as well as their speaking and writing skills.

Teaching hours

Tutorials	Tutorials	15

Mandatory prerequisites

Minimum TOEIC score of 785 obtained at the end of semester 5 (Lang 501)

Course outline

Various presentations by professionals, mainly English-speaking teachers or external speakers

Targeted skills

Communicate independently, both orally and in writing, in all situations in an international professional setting.

Bibliography

A variety of authentic materials provided by the speakers and/or the students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern Language 2

Polytech Annecy-Chambéry

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
German TD Spanish	SUBJECT		3:00		
TD Italian TD	SUBJECT		p.m.		
Chinese TD	SUBJECT		3:00		
Japanese TD	SUBJECT		p.m.		
Russian TD	SUBJECT		3:00		
Advanced English S6	SUBJECT		p.m.		
	SUBJECT		3:00		
			p.m.		
			3:00		
			p.m.		
			9:00 p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

German TD (ALLE201D1_IUTA)

Annecy University Institute of Technology

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Overview

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Spanish TD (ESPA201D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Italian TD (ITAL201D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Chinese TD (CHIN201D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Overview

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Japanese TD (JAPO201D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Russian TD (RUSS201D1_IUTA)

Annecy IUT component

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Advanced English S6 (ENGL602_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: English, French **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course is an introduction to professional English. Students will work on their fluency in the five language skills by enriching their technical and professional vocabulary, participating in role-plays and simulations, learning about cultural aspects, and completing written exercises.

Activities will be carried out individually, in pairs, and/or in groups. Students will be assessed throughout the semester.

Objectives

The objective is to improve students' autonomy in the English-speaking workplace in an international context.

Teaching hours

Tutorials	Tutorials	21

Mandatory prerequisites

Minimum TOEIC score of 785 and semester 501 completed

Course outline

Various presentations by professionals, mainly English-speaking teachers or external speakers

Targeted skills

Communicate independently, both orally and in writing, in all situations in a professional setting.

Bibliography

A variety of authentic materials provided by the speakers and/or students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Optional internship S6 (PROJ600_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The optional internship aims to enrich students' academic and professional experience by offering them a practical opportunity to apply their knowledge and acquire new skills. An optional internship can be completed **in France or abroad**. It must comply with the same general conditions as compulsory internships.

Objectives

- **Acquisition of** specific skills related to the specialization;
- **Refining career goals and/or** gaining confidence and independence through the completion of a project or specific tasks;
- Establish valuable professional contacts that can help in future job searches.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course Director, Polytech Business Relations

Relations-Entreprises.Polytech@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Support (every Thursday afternoon when FISA representatives are present) (ACCO601_PACY)

Polytech Annecy-Chambéry
component

In brief

Teaching methods: In person **Teaching format:** Tutored project **Open to exchange students:** Yes

Presentation

Description

This support is open to all students at the school: students, apprentices, and Continuing Education employees. It is not mandatory, as it is primarily intended for students who need it to succeed in their training. This semester, it is scheduled into the timetable for each course, with a total of 32 hours.

Support may take the form of refresher courses, upgrading courses, or support in the main areas of the training programs.

Peer tutoring is encouraged and the educational resources of the Polytech Network are used (https://eplanet.polytech-reseau.org/).

Objectives

To promote the success of all students in their educational journey.

Teaching hours

PTUT	Tutored project	32

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Director of Training, Polytech

Locations

Annecy-le-Vieux (74)

UE602 Instrumentation and Project-Based Learning

ECTS
8 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Electromagnetism and optics applied to information transmission Project-based learning	MODULE	23.5 hours	6 p.m.	8 p.m.	
Instrumentation electronics: essential concepts for engineers	MODULE				
	MODULE	12 p.m.			
			12 p.m.	12 p.m.	

Practical information

Locations

Annecy-le-Vieux (74)

Electromagnetism and optics applied to information transmission (PACI642_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person **Open to exchange students:** Yes **ERASMUS reference:** Physical sciences

Presentation

Description

This course provides the fundamentals of geometric and wave optics necessary for understanding systems that use optical transmission. Matrix formalism and numerical simulation are used to give future engineers reliable methods for quickly and easily describing how an optical system works.

Objectives

1) describe the functioning of a geometric optical system based on its equivalent elements, using a matrix approach with the concepts of object, image, magnification, and enlargement

2) describe the polarization state of a light wave using complex notation and use matrix formalism to calculate the effect of a polarizer or retardation plate on any polarization state. Model and understand interference and diffraction phenomena and know the common applications of these phenomena

3) Describe the propagation and confinement of light in a plane guide and/or optical fiber structure

Teaching hours

Lectures		Lecture	23.5
Tutorial		Tutorials	18
Lab		Practical work	8 p.m.

Mandatory prerequisites

PHYS542: Electromagnetism applied to information transmission

Course outline

1. Geometric optics (light propagation, general information on optical instruments, matrix processing)
2. Wave Optics (propagation of a pulse, the "wave" nature of light, photometry, polarization: matrix processing, applications of interference and diffraction phenomena)
3. Optical microscopy
4. Guided optics and optical transmission

Targeted skills

Be able to describe the functioning of any geometric optical system (concepts of object, image, magnification, enlargement)

know how to use matrix formalism to understand the action of a polarizer or a retardation plate and understand the phenomena of interference and diffraction,

understand the concept of modes in guided optics and calculate the number of modes for a given plane guide

Bibliography

- Optics, Eugene Hecht, Pearson, 2005
- Optics Manual, G Chartier, Hermes, 1997
- Introduction to Matrix Methods in Optics, A Gerrard and JM Burch, Wiley 1994

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Yannick Mugnier
+33 4 50 09 65 16
Yannick.Mugnier@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Project-Based Learning (PROJ641_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In-person
Teaching format: Tutored project **Open to exchange students:** Yes

Presentation

Description

Project-based learning (PBL) in the SNI specialization consists of developing the skills targeted by academic training in engineering students by placing them in authentic situations, similar to those they may encounter in their professional lives, in attractive and motivating topics of the future:

- Smart Buildings (SB) and Connected Objects (CO)
- Renewable Energy Management (REM): photovoltaic, wind turbine, tidal turbine
- Imaging for the environment (IE)
- Service Robotics (SR): computer processing
- Health (H)

These themes are the common thread running through APP activities, which are spread over three to five semesters at a rate of one module per semester (36-hour module in semesters 6, 7, and 9; 60-hour module in semester 8). The work is carried out in teams (between four and seven engineering students) throughout the semesters.

Objectives

At the end of this module, students will be able to:
- organize work into tasks

- distribute tasks among team members
- organize and lead a work meeting
- position themselves in relation to the team in terms of skills
- develop by acquiring or developing new skills
- conduct bibliographic research in a new field
- list the knowledge and concepts useful to a project and identify those that need to be acquired
- seek external information and experiences that could contribute to the progress of the project
- approach the modeling of the system, process, or application to be developed

Teaching hours

PTUT	Tutored project	6
PROJ	Project	18

Mandatory prerequisites

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Lionel Valet

+33 4 50 09 65 25
Lionel.Valet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Instrumentation electronics: essential concepts for engineers (PACI641_SNI)

Polytech Annecy-Chambéry
component

In

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

ERASMUS reference: Engineering and related techniques

Presentation

Description

This module covers the basic electronic blocks necessary to understand the essential elements of a data acquisition system.

The system often consists of one or more electronic cards comprising an analog section and a digital section, which may or may not be equipped with a microcontroller. The following topics will be covered in varying degrees of detail: interfacing the sensor to analog electronics, low-noise amplification, signal shaping amplification, sample-and-hold circuits, analog-to-digital conversion, digital-to-analog conversion, the concept of FPGAs, and finally, digital data transmission protocols and circuits.

Objectives

This course aims to enable students to understand, propose, and implement a data acquisition system for a specific instrumentation application.

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12
Lab	Practical Work	12

Mandatory prerequisites

- Fundamentals of analog electronics: circuits with active and passive components, transistors, amplifiers, filters.
- Basics of digital electronics: basics of digital logic, logic gates, flip-flops, switches, and memory components.

Course outline

- Interface of the sensor to the front end electronics (2 hours lectures + 2 hours exercises)
- Low noise amplification
- Shapers, sample and hold circuits
- Analog-to-digital conversion (ADC), digital-to-analog conversion (DAC)
- FPGA, concepts
- Protocols and data transmission

- Amplification and amplifiers
- Sample and hold followed by an ADC and data storage
- A data acquisition system with a microcontroller

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Madjid Boutemeur
+33 4 50 09 65 71
Madjid.Boutemeur@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE603 Information Processing and Automation

ECTS
10 credits

Polytech Annecy-Chambéry component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Signals and Systems	MODULE	12 hours	12	12	
Signals and images: basic operators Mathematics	MODULE	13.5 hours	13.5	9	
Introduction to machine learning	MODULE	18 hours	18h		
	MODULE	18h	18h		

Practical information

Location

Annecy-le-Vieux (74)

Signals and Systems (EASI641_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Presentation

Description

At the end of this module, students will be able to represent the behavior of a linear dynamic system, in continuous time or sampled time, using a transfer function. For any system modeled by a transfer function, they will also be able to analyze its temporal behavior (index response) and frequency behavior (Bode diagram).

Objectives

Master the representation of linear dynamic systems using transfer functions (continuous time, sampled time).

Be able to analyze the behavior of a system, in both the time domain and the frequency domain, based on its transfer function.

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12
Lab	Practical Work	12

Mandatory prerequisites

Basic concepts of differential equations and recursive equations. Basic concepts and operations involving complex numbers.

Course outline

1. Introduction

1.1. Concept of systems and variables

1.2. Concept of causality

1.3. Concept of models

1.4. Continuous time, sampled time

2. Signals

2.1. Introduction

2.2. The Laplace transform

2.3. The Z transform

3. Transfer function

3.1. Introduction

3.2. Continuous-time systems

3.3. Discrete-time systems

3.4. Sampled continuous-time systems

3.5. Representation of a system using a block diagram

4. Time and frequency analysis of continuous linear systems of order 1 and order 2

4.1. Introduction

4.2. Time analysis

4.3. Frequency analysis

4.4. First-order systems

4.5. Second-order systems

Additional information

None.

Bibliography

"Automatique - Systèmes linéaires, non linéaires, à temps continu, à temps discret, représentation d'état" (Automation - Linear, nonlinear, continuous-time, discrete-time systems, state representation), Yves GRANJON, 4th edition, 2021, DUNOD.

"Basic Automation - Lectures and Corrected Exercises," Mohamed DAROUACH, Philippe PIERROT, Michel ZASADZINSKI, 2019, ELLIPSES.

"Control of Continuous Linear Systems - Exercises and Methods," Yves GRANJON, 2022, DUNOD. "Control Theory - Linear and Continuous Systems," Sandrine LE BALLOIS, Pascal CODRON,

2nd edition, 2006, DUNOD.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal Mouille
+33 4 50 09 65 81
Pascal.Mouille@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Signal and image: basic operators (EASI642_SNI)

Polytech Annecy-Chambéry

Time of year Spring

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Lecture **Open to exchange students:** Yes

Capacity: 30

ERASMUS reference: Engineering and related techniques

Presentation

Description

Based on analog signal modeling, this course aims to provide the necessary concepts for filtering and analyzing 1D and 2D digital signals. The concepts covered include:

- temporal analysis of deterministic signals
- frequency analysis of deterministic signals
- analog linear filtering
- digital signals: modeling and filtering
- 2D signals and images: representation and filtering

Objectives

This course aims to provide a general introduction to signal processing, covering the basic concepts.

Teaching hours

Lectures	Lecture	13.5
Tutorial	Tutorials	13.5
Lab	Practical work	9 a.m.

Mandatory prerequisites

vector spaces, scalar product, integral

Course outline

1. **Representation of deterministic signals with finite energy and finite average power** (temporal and frequency analysis, filtering)
2. **Digital signals**: sampling and quantization, frequency aspects
3. **1D linear digital filtering**: frequency approach and circular convolution, time approach and RIF filtering, difference equation and RII filtering
4. **2D signals**: filtering and edge detection in images, signal and image compression; introduction to graph signals

Additional information

N/A.

Bibliography

Signal Processing, Emmanuel Trouvé - Philippe Bolon

http://culturesciencesphysique.ens-lyon.fr/ressource/numerisation-acoustique-Chareyron2.xml

https://www.youtube.com/watch?v=4XCSoFLFLNE

https://glq2200.clberube.org/chapitres/docs/signal-fourier

https://www.youtube.com/watch?v=7cLmZAbRo1o https://www.youtube.com/watch?v=fzGi84wanDU

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Yajing Yan
+33 4 50 09 65 36
Yajing.Yan@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Mathematics (MATH641_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Mathematics and statistics

Presentation

Description

This course is divided into three parts:

- Complements to linear algebra, matrix reductions
- Euclidean and Hermitian spaces
- Sequences and series of functions, different types of convergence

Objectives

Specific objectives: by the end of this course, students will be able to:

recognize diagonalizable or triangularizable matrices, find eigenvalues, construct a basis for eigenspaces, calculate the powers and exponential of a matrix, solve systems of first-order linear differential equations;

use different scalar products on vectors, make the connection with least squares approximations;

recognize different types of convergence, solve differential equations using entire series, extend usual functions to complex variables, decompose a signal into Fourier series

Teaching hours

Lectures	Lecture	18
Tutorial	Tutorials	6 p.m.

Mandatory prerequisites

Basic linear algebra (vector spaces, matrix operations), elementary analysis, numerical series

Course outline

1. Additional algebra
    1. Vector spaces, linear applications, determinants
    2. Matrix reduction and diagonalization
2. Euclidean and Hermitian spaces
    1. Scalar product and Hermitian product

2. Orthonormal bases,
3. Orthogonal projections
4. Orthogonal and Hermitian matrices

3. Sequences and series of signals
   1. Types of convergence, conservation of properties, entire series, application to differential equations
   2. Extension of standard functions to complex variables. Fourier series

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Alexandre Bascop
+33 4 50 09 66 18
Alexandre.Bascop@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Introduction to Machine Learning (DATA641_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Mathematics and Statistics

Presentation

Description

This course provides essential mathematical background for understanding, representing, and analyzing data. The first part of the course covers distribution theory, which is fundamental when the data being analyzed is associated with analog signals. This part provides a better understanding and manipulation of the mathematics used in signal and information processing, as well as other physical phenomena that cannot be represented by classical functions. The second part of the course covers the mathematics required for digital data analysis. It includes the study of the mathematics required for the analysis of discrete signals and other digital information (discrete convolution, Z-transform, discrete Fourier transform, etc.). It also develops optimization techniques and methods. This part provides a set of mathematical tools essential for solving problems in analysis, machine learning, and information retrieval in data.

Objectives

Use the formalism of distributions to solve mathematical problems Justify the choice between different representations of signals or systems

Teaching hours

Lectures		Lecture	18
Tutorial		Tutorials	6 p.m.

Mandatory prerequisites

Basic knowledge of functions, numerical sequences and series, integration.

Course outline

1. Complement to integral calculus
   1. Generalized integrals and integrals depending on a parameter
   2. Convolution product of functions
   3. Fourier transforms and Laplace transforms of functions
   4. Functional spaces, test function spaces
2. Schwartz distributions and tempered distributions
   1. Regular and singular distributions (of Schwartz)
   2. Operations on distributions (translation, scaling, derivation, etc.)
   3. Convolution product of distributions
   4. Causal distributions and Laplace transform (LT) of distributions
   5. Moderate distributions and Fourier transform (FT) of distributions
3. Sampling theory
   1. Mathematical model of sampling
   2. Representation in the Fourier domain
   3. Reconstruction theorem (Shannon) of sampled functions
   4. Fourier transform of sampled functions
4. Discrete convolution and Z-transform
   1. Discrete convolution
   2. Z-transform
5. Introduction to optimization
   1. Unconstrained optimization
   2. Optimization with Equality Constraints
   3. Optimization under inequality constraints

Bibliography

Laurent Schwartz, Distribution Theory.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Abdourrahmane Atto
+33 4 50 09 65 27
Abdourrahmane.Atto@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE604 Embedded Computing

ECTS
4 credits

Polytech Annecy-Chambéry
component

List of courses

	Type	Lecture	Tutorial	Practical	Credits
Databases and web technologies	MODULE		13.5		
Embedded Systems I	MODULE	9 hours	3	24	

Practical information

Locations

Annecy-le-Vieux (74)

Databases and Web Technologies (INFO642_SNI)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

ERASMUS reference: Information and Communication Technologies (ICT)

Overview

Description

This course focuses on the design and implementation of a complete web application. Information is modeled and represented in a database. Access to the database is then achieved through a web server that generates the application's web pages. The application is accessible from an embedded system that can generate data or access data (display, analysis, etc.).

Objectives

The objective of this course is to learn how to use web tools to manipulate data from sensors or any type of embedded system. The main web languages (SQL, HTML, CSS, JavaScript) will be used to create medium-sized applications, consisting of a relational database, a server part, and a client part.

Teaching hours

Tutorials	Tutorials	13.5
AUTO	Independent study	6
PROJ	Project	12 hours
PTUT	Supervised project	4 hours

Mandatory prerequisites

The basics of programming and databases.

An introduction to computer networks.

Course outline

Part 1: Review of data modeling for storage in a database (entity association model, relational data model)

Part 2: Querying a database (advanced SQL queries)

Part 3: Displaying data on a web page (principles of web page construction, generation from a server, retrieving data from a database, and integrating it into the web page content)

Part 4: Discovering functions, procedures, and triggers in SQL and using them from a web page (introduction to web forms)

Part 5: Integrating knowledge through a mini website development project involving data manipulation, in connection with embedded systems.

Targeted skills

This course aims to enable students to:

- design and implement a medium-sized third-party application,
- design the organization of data using an entity-association model and translate it into a relational database,
- access data through a web server, design web interfaces for data representation and manipulation,

- use current technologies such as Postgres or MySQL DBMS, SQL, PHP, CSS, HTML, JavaScript, etc.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Lionel Valet
+33 4 50 09 65 25
Lionel.Valet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Embedded Systems I (INFO641_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In-person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Overview

Description

This course aims to present the characteristics of embedded systems. Hardware and software aspects are addressed from a systems perspective. Important concepts related to embedded systems management are discussed and put into practice in a mini-project (input/output, interrupts, CPU time sharing, multi-threaded programming, operating system kernel features, etc.).

Objectives

Propose a technological solution for creating an embedded system

Propose and justify a solution for implementing embedded software (with or without an OS)

Specify, design, and implement a simple embedded software application using external exchanges (input/output management, interrupt implementation, shared memory, etc.)

Determine the criticality of software processing (concepts of real time, scheduling, priority management, and multitasking)

Teaching hours

Lectures	Lecture	9
TD	Tutorials	3
Lab	Practical work	24

Mandatory prerequisites

INFO501: Numbering and Algorithms

Course outline

- General architecture of an embedded system
  1. Characteristics: technical and functional aspects
  2. Constraints of embedded systems
- Input/Output
  1. Understanding the role of a device driver and being able to use it in an application
  2. Understanding and implementing the management of an I/O interface circuit
  3. Understanding the interrupt mechanism and knowing how to implement it

Targeted skills

Specify, analyze, design, and implement computer systems, particularly embedded systems and communication systems (Application)

- by integrating interactions between the application and software and hardware architectures

- using methods for designing and managing medium-sized IT projects

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Guillaume Ginolhac

+33 4 50 09 65 83

Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE701 Bridge to the professional world

ECTS
6 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Resources and professional dynamics	MODULE		13.5 hours	3.5	
Creativity and innovation management	MODULE		25.5		

	Nature	Lecture	Tutorial	Practical	Credits
English (TOEIC level not achieved) S7	MODULE		40.5		
Modern languages (TOEIC level achieved)	MODULE				
English S7 Modern language 2	SUBJECT CHOICE		3 p.m.		
German TD	SUBJECT		3 p.m.		
Spanish TD Italian	SUBJECT		3 p.m.		
TD Chinese TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Russian TD	SUBJECT		3 p.m.		
Advanced English S7	SUBJECT		3 p.m.		
	SUBJECT		9 p.m.		

	Nature	CM	Tutorial	Practical	Credits
Optional internship S7	MODULE				
Support (half of the Thursday afternoons when the FISA are present)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Resources and professional dynamics (SHES703_PACY)

Polytech Annecy-Chambéry component

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

ERASMUS reference: Information and Communication Technologies (ICT)

Overview

Description

Professional integration module designed and implemented in collaboration with the Business Club and the Professional Integration Assistance Office of the University of Savoie Mont Blanc, involving a network of qualified professionals.

Objectives

The aim of the module is to help students gain a better understanding of themselves in order to define a career plan in line with their motivation and skills, develop a targeted internship and/or job search strategy, present themselves effectively in an interview, and promote their career path.

Teaching hours

Tutorials	Tutorials	13.5
TP	Practical work	0.5
TP	Practical work	3

Mandatory prerequisites

No mandatory prerequisites

Course outline

- Introduction: preparing for my future today
- Identify my professional environment, map out the possibilities
- Defining my career plan
- Boost my internship search efforts
- Create and optimize my LinkedIn profile
- Adapt my application tools, respond to a job posting
- Prepare for the interview
- Promoting my work experience as an intern - Assessment
- Simulated interview with professionals - Assessment

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Carole Mislin
+33 4 50 09 66 46
Carole.Mislin@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Creativity and Innovation Management (SHES704_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French **Teaching methods:** In person

Teaching format: Tutorials **Open to exchange students:** Yes

ERASMUS reference: Business and administration

Presentation

Description

How can creativity and innovation be leveraged to enhance an organization? How can radical innovation be initiated based on the latest technological advances? This requires a thorough understanding of the innovation process as well as the ability to manage an innovative project in a complex and uncertain environment. It also involves adopting an entrepreneurial or intrapreneurial approach to mobilize and motivate interdisciplinary teams to achieve innovation. This training module offers the opportunity to acquire the methodologies and attitudes necessary to achieve these objectives.

Objectives

- Structure, organize, and manage a highly exploratory process with a consistent approach
- Find resources or make do with available resources
- Adapt in real time to changes in context and constraints
- Manage the challenges of each phase of the project
- Act as a leader in an uncertain environment
- Mobilize stakeholders

- Master new technologies

Teaching hours

Tutorials	Tutorials	25.5

Mandatory prerequisites

None

Course outline

Part 1: Innovation management: theoretical foundations

Part 2: Creativity - Design thinking approach (different creativity tools depending on the stages of the process). Part 3: Role-playing

Targeted skills

- Recognize and seize internal and external development opportunities
- Develop and formalize opportunities to transform them into innovative projects
- Know how to lead a design thinking-type creative process
- Develop management and leadership skills for innovative projects: challenge preconceived ideas, mobilize stakeholders, lead with flexibility, and seize opportunities with agility

Bibliography

Tidd, Joe, and John Bessant. *Managing Innovation: Integrating Technological, Commercial, and Organizational Change*. Paris, Pearson, 2018.

Kim, W. Chan, and Renée Mauborgne. *Blue Ocean Strategy: How to Create New Strategic Spaces*. Paris, Pearson, 2006.

Christensen, Clayton M. *The Innovator's Dilemma: Why High-Tech Companies Miss Market Changes*. Paris, Village Mondial, 2003.

Lockwood, Thomas, and Thomas Walton. *Design Thinking: Integrating Innovation, User Experience, and Brand Value.*
Paris, Dunod, 2013.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Elodie Gardet
+33 4 50 09 24 51
Elodie.Gardet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

English (TOEIC level not achieved) S7 (LANG701_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

This course prepares students for the TOEIC (Test of English for International Communication) exam, specifically to obtain a minimum score of 785 points (out of 990).

With the aim of developing all four skills, this course also serves as an introduction to public speaking through presentations given by students in groups or individually on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate, as well as written work). Depending on the location (Annecy or Chambéry), some will be seen at different times during the semester, the year, or even the three years of training.

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam.

Objectives

Specific objectives: at the end of this course, students will be able to:

work on telephone conversations (comprehension/production)

listen regularly to news on English-language news sites (CNN, BBC, Sky News, etc.) and be able to succinctly summarize the main points orally, interacting with the class

work on a variety of audio and video materials and speak spontaneously in an interactive manner with the class

to speak in a prepared manner and interact spontaneously through individual presentations (self-presentations and/or article reviews, such as "quizzes") and presentations in pairs (various topics)

practice TOEIC exercises (4 parts of listening comprehension) + entire tests

Teaching hours

Tutorials	Tutorials	40.5

Mandatory prerequisites

S5 and S6 program.

Course outline

Course outline

1. **Review of important grammar points for the TOEIC:**
    1. Review of tenses.
    2. The conditional and "should" structures (suggestion/subjunctive).
    3. Modal auxiliaries and periphrases with similar meanings.
    4. Linking words (review).
2. **Listening comprehension:**
    1. Recorded dialogues in American, British, and New Zealand English.
    2. Videos in American, British, and Australian English.
3. **Reading comprehension:**
    1. Press excerpts
    2. Various texts

Bibliography

- Documents distributed by speakers
- Various websites, a list of which is provided at the beginning of S5

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern Languages (TOEIC Level Achieved) (LANG702_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
English S7	SUBJECT		15		
Modern Language 2	CHOICE				
German TD Spanish	SUBJECT		3:00		
TD Italian TD	SUBJECT		p.m.		
Chinese TD	SUBJECT		3:00		
Japanese TD	SUBJECT		p.m.		
Russian TD	SUBJECT		3:00		
Advanced English S7	SUBJECT		p.m.		
	SUBJECT		3:00		
	SUBJECT		p.m.		
	SUBJECT		3:00		
			p.m.		
			3:00		
			p.m.		
			9:00		
			p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

English S7 (LANG702_PACYM1)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

This course focuses on acquiring professional English skills. Students will work on developing their fluency in the five skills (group project). Students will develop their skills through the study of specific topics and/or develop their intercultural knowledge.

Objectives

The objective is to improve students' autonomy in the English-speaking workplace in an international context.

Teaching hours

Tutorial	Tutorials	15

Mandatory prerequisites

TOEIC score of 785 or higher and completion of semester 601 or 602

Course outline

Various presentations by professionals, mainly English-speaking teachers or external speakers

Targeted skills

Communicate independently, both orally and in writing, in all situations in a professional setting.

Bibliography

A variety of authentic materials provided by the speakers and/or students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern language 2

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	CM	Tutorial	Practical work	Credits
German TD Spanish	SUBJECT		3 p.m.		
TD Italian TD	SUBJECT		3 p.m.		
Chinese TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Russian TD	SUBJECT		3 p.m.		
Advanced English S7	SUBJECT		3 p.m.		
	SUBJECT		9:00 p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

German TD (ALLE101D1_IUTA)

Annecy University Institute of Technology

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Spanish TD (ESPA101D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Italian TD (ITAL101D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Chinese TD (CHIN101D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Overview

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Japanese TD (JAPO101D1_IUTA)

Annecy IUT

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Russian TD (RUSS101D1_IUTA)

Annecy IUT component

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Languages

Presentation

Teaching hours

Tutorial	Tutorials	15

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Advanced English S7 (ENGL702_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: English, French **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course is a training course in professional English. Students will work on their fluency in the five language skills by enriching their technical and professional vocabulary, through role-playing, cultural contributions, and written exercises (different topics from 602).

Activities will be carried out individually, in pairs, and/or in groups. Students will be assessed throughout the semester.

Objectives

The objective is to improve students' autonomy in the English-speaking workplace in an international context.

Teaching hours

Tutorials	Tutorials	9 p.m.

Mandatory prerequisites

Minimum TOEIC score of 785 – Semester 601 and/or 602 completed

Course outline

Various presentations by professionals, mainly English-speaking teachers or external speakers.

Targeted skills

Communicate independently, both orally and in writing, in all situations in a professional setting.

Bibliography

A variety of authentic materials provided by the speakers and/or students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Optional internship S7 (PROJ700_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The optional internship aims to enrich students' academic and professional experience by offering them a practical opportunity to apply their knowledge and acquire new skills. An optional internship can be carried out **in France or abroad**. It must comply with the same general conditions as compulsory internships.

Objectives

- **Acquisition of** specific skills related to the specialization;
- **Refining career goals and/or** gaining confidence and independence through the completion of a project or specific tasks;
- Establish valuable professional contacts that can help in future job searches.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course Director, Polytech Business Relations

Relations-Entreprises.Polytech@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Support (half of the Thursday afternoons when FISA is present) (ACCO701_PACY)

Polytech Annecy-Chambéry
component

In brief

Teaching methods: In person **Teaching format:** Tutored project **Open to exchange students:** Yes

Presentation

Description

This support is open to all students at the school: students, apprentices, and Continuing Education employees. It is not mandatory, as it is primarily intended for students who need it to succeed in their training. This semester, it is scheduled into each training program's timetable, with a total of 16 hours.

Support may take the form of refresher courses, upgrading courses, or support in the main areas of training.

Peer tutoring is encouraged and the educational resources of the Polytech Network are used (https://eplanet.polytech-reseau.org/).

Objectives

Promoting success for all students in their educational journey

Teaching hours

PTUT	Tutored project	16

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Director of Polytech Training

Locations

Annecy-le-Vieux (74)

Le Bourget-du-Lac (73)

UE702 Instrumentation

ECTS
8 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Data acquisition systems - Graphical programming	MODULE	4.5 hours		32	
Functional materials for instrumentation	MODULE	21.5 hours	18		
Actuator sizing	MODULE	7.5 hours	4.5 hours	12 hours	

Practical information

Location

Annecy-le-Vieux (74)

Data acquisition systems - Graphical programming (PACI742_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In-person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Overview

Description

Program digital data acquisition/generation systems using a graphical language (LabVIEW).

Objectives

Understand the different components of the analog or digital signal acquisition chain Implement the different possibilities offered by an acquisition device associated with a computer

Design, based on the description of an instrumentation requirement, the software application that uses the acquisition/generation hardware implemented.

Teaching hours

Lectures	Lecture	4.5
Lab	Practical work	32

Mandatory prerequisites

Must have completed modules EASI501 and PACI741 or possess equivalent knowledge.

Course outline

1. Digital acquisition/generation systems: architectures, performance, and programming
2. Digital-to-analog and analog-to-digital converters *(review)*
    1. Digital-to-analog converters: structures, operating principles, and performance
    2. Analog-to-digital converters:
        1. Voltage balance: Structures, principles, and performance
        2. Load balancing: Structures, principles, and performance
        3. Sigma/Delta converters

Additional information

N/A

Bibliography

- Francis COTTET, LabVIEW: Programming and Applications, DUNOD
- Francis COTTET, Signal Processing and Data Acquisition, DUNOD
- NI website: www.ni.com

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Michelle Passard
+33 4 50 09 66 01
Michelle.Passard@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Functional Materials for Instrumentation (PACI741_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Open to exchange students:** Yes
ERASMUS reference: Physical sciences

Presentation

Description

This course describes materials with specific properties used in sensors, actuators, and mechatronic devices: explanation of the physical phenomena involved in these materials, description of behavior models that account for their properties, and applications.

This course describes the specific properties of smart materials used in sensors, actuators, and mechatronic devices. Physical phenomena involved in these materials, description of behavior models, physical properties, and applications are explained.

Objectives

- Identify the classes of active materials used in various measurement and transduction applications.
- Explain the behavior of different classes of materials in response to electrical, magnetic, and electromagnetic stresses.

Teaching hours

Lectures	Lecture	21.5
Tutorial	Tutorials	18

Mandatory prerequisites

- Fundamentals of general physics
- Electromagnetism.
- Mathematical tools: integrals, derivatives, coordinate systems, operators, vector analysis, matrix calculus

Course outline

1. Dielectric properties: polarization, dielectric strength and permittivity, pyroelectricity and ferroelectricity
2. Piezoelectric materials
3. Piezoresistive and electrostrictive materials
4. Magnetic properties of materials: magnetization, magnetic permeability, para-, dia-, and ferromagnetism
5. Magnetoresistive and magnetostrictive materials
6. Birefringence and electro-optic modulation

Bibliography

- David Jiles, Introduction to magnetism and magnetic materials, Ed Chapmann and Hall, 1994
- Yuhuan Xu, Ferroelectric Materials and their applications, Ed North-Holland, Elsevier, 1991

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Thomas Mazingue-Desailly +33 4 50 09 65 68
Thomas.Mazingue-Desailly@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Actuator sizing (PACI743_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Overview

Description

Whether in terms of production tools or manufactured products, electric actuators are ubiquitous in the world of technical systems.

Focusing solely on rotating electrical machines, this course aims to provide the necessary foundations for understanding how they work and how they are controlled using electronic controllers. The essential elements for selecting and sizing a motor will also be covered.

Preference will be given to motor technologies commonly found in embedded, mechanical, and mechatronic systems.

Objectives

By the end of this course, students will be able to:

* present the different components involved in an electric motor

* explain the general operating principles of a rotating electric machine

* choose between DC motor, brushless DC motor, or stepper motor technology for a given application

* to size the machine according to the needs of the application

* implement the selected equipment

Teaching hours

Lectures	Lecture	7.5
Tutorial	Tutorials	4.5
Lab	Practical work	12

Mandatory prerequisites

Scientific and technological knowledge from the first cycle of university studies. In particular, the general laws governing the study of electrical circuits and those governing the mechanics of rotating solids.

Course outline

1. Introductions, general information
    1. Benefits and structure of electric motors
    2. Brief review of electromagnetism
    3. General operating principle of a rotating machine
    4. Classifications
    5. Machine losses
2. Principles and characteristics of certain technologies
    1. Direct current machine
    2. Brushless DC motor
    3. Stepper motor
3. Dimensioning approach
    1. Conventional loads
    2. Transmission
    3. Steady state
    4. Dynamic operating conditions
    5. Thermal criteria in cyclic operation

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Michel Cuny
+33 4 50 09 66 20
Michel.Cuny@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE703 Information Processing and Automation

ECTS
7 credits

Polytech Annecy-Chambéry component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Random signals	MODULE	12	12 hours	12	
Automatic - Stability and control of systems	MODULE	10	10.5	4 p.m.	
Probability - Statistics	MODULE	18	6 p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

Random signals (EASI741_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In-person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Overview

Description

At the end of this module, students will be able to

- define the properties of a random process that varies over time
- explain the estimators of the statistical properties of a random process in digital form (autocorrelation, spectral density, etc.)
- illustrate the concepts of random signals through several applications in optimal filtering, detection, estimation, etc.

Objectives

The objectives of the module are:

- to explain the definitions related to a random process
- interpret the ergodicity theorem in terms of signal processing
- to apply the various estimators of the autocorrelation function and spectral density
- to predict the behavior of these estimators based on different parameters
- to identify the appropriate processing for the signals encountered based on specifications
- use a recursive least squares program, LMS, etc.

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12
Lab	Practical Work	12

Mandatory prerequisites

- MATH642 - Specialized Mathematics
- EASI641 - Fundamentals of Signal Processing

Course outline

1. Random signals
    1. Random variables,
    2. Random signals,
    3. Statistical properties: distributions, independence, stationarity,
    4. Temporal properties: ergodicity, Frequency representation of stationary random signals in the broad sense,
    5. Linear operations on random signals
2. Estimation:
    1. General definitions relating to estimation,
    2. Estimation of the autocorrelation function,
    3. Estimation of the PSD
3. Adaptive filtering
    1. Introduction,
    2. Wiener filter,
    3. Exact and weighted least squares,
    4. Recursive Least Squares (RLS),
    5. Adaptive filtering using the gradient algorithm (LMS)

Additional information

The course will then be used in AI modules and in the information processing project.

Targeted skills

Extract information and knowledge through data processing (application)

- using modeling and statistical processing of numerical and symbolic data
- using methods for designing and managing medium-sized IT projects making decisions based on measurements, environmental observations, models, and criteria
- by relying on modeling and statistical processing of digital and symbolic data
- by integrating interactions between the application and software and hardware architectures

Bibliography

- Signal processing methods and techniques. Jacques Max and Jean Louis Lacoume - 5th edition Dunod
- Adaptive filtering: theory and algorithms. François Michaud and Maurice Bellanger - Hermès

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Guillaume Ginolhac

+33 4 50 09 65 83

Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Automatic - Stability and System Control (EASI744_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Overview

Description

Study of the stability and control of continuous linear dynamic systems.

Objectives

Be able to analyze the stability of a system (open loop) or a control system (closed loop) based on its transfer function (continuous time).

Master the concept of closed-loop control.

Be familiar with standard controllers (P, PI, PID) and know how to synthesize them (model method) to guarantee the desired closed-loop performance.

Teaching hours

Lectures	Lecture	10
Tutorial	Tutorials	10.5
Lab	Practical Work	16 hours

Mandatory prerequisites

Module EASI641 (Signals and Systems)

Course outline

1. Introduction

1.1. Concept of system stability

1.2. Concept of closed-loop systems (closed-loop control)

2. Stability of linear dynamic systems

2.1. Introduction

2.2. A few reminders about linear systems (EASI641)

2.3. Stability condition

2.4. Routh's criterion

2.5. Stability of closed-loop systems

3. Standard correctors

3.1. Introduction

3.2. PID controllers

3.3. Main actions (P, I, D, filtered D)

3.4. Standard controllers

4. Controller tuning using the model method

4.1. The problem

4.2. First-order process

Additional information

None.

Bibliography

"Automatique - Systèmes linéaires, non linéaires, à temps continu, à temps discret, représentation d'état" (Automation - Linear, nonlinear, continuous-time, discrete-time systems, state representation), Yves GRANJON, 4th edition, 2021, DUNOD.

"Basic Automation - Lectures and Corrected Exercises," Mohamed DAROUACH, Philippe PIERROT, Michel ZASADZINSKI, 2019, ELLIPSES.

"Behavior of Servo Systems," Christophe FRANCOIS, 2014, ELLIPSES.

"Continuous Linear Systems Control - Exercises and Methods," Yves GRANJON, 2022, DUNOD. "Control Systems - Linear and Continuous Systems," Sandrine LE BALLOIS, Pascal CODRON,

2nd edition, 2006, DUNOD. "Automation - Control and Regulation," Patrick PROUVOST, 2nd edition, 2010, DUNOD.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal Mouille

+33 4 50 09 65 81

Pascal.Mouille@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Probability and Statistics (MATH741_SNI)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

Presentation

Description

This course covers the main concepts of probability and statistics useful in engineering sciences in order to know how to use them to model concrete situations.

Objectives

By the end of this course, students will be able to:

manipulate discrete or continuous variables, understand and use classical laws, find the law of a random variable and a sum of random variables

Teaching hours

Lectures	Lecture	18
Tutorial	Tutorials	6 p.m.

Mandatory prerequisites

Numerical series, generalized integrals.

Course outline

1. Probability
    1. Definitions, enumeration, probability laws, conditional probability, and independence.
    2. Discrete random variables and common discrete probability distributions
    3. Continuous random variables and main continuous laws
    4. Pairs of random variables
    5. Joint and marginal laws
    6. Convergence of sequences of random variables
    7. Approximations by classical distributions
2. Statistics
    1. Descriptive statistics
    2. Double statistical series, different types of regression
    3. Estimates: definitions, estimation by confidence intervals, etc.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Alexandre Bascop
+33 4 50 09 66 18
Alexandre.Bascop@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE704 Embedded Computing and Project-Based Learning

ECTS
9 credits

Polytech Annecy-Chambéry
component

List of courses

	Type	Lectures	Tutorial	Practical	Credits
Networks and security for embedded systems Project-based learning	MODULE	25.5 hours		36	
Embedded Systems and Concurrent Programming	MODULE				
	MODULE	9			
			3	24	

Practical information

Locations

Annecy-le-Vieux (74)

Networks and security for embedded systems (INFO743_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Teaching format: Lecture **Open to exchange students:** Yes
ERASMUS reference: Engineering and related techniques

Presentation

Description

This course will introduce computer and field networks and related security elements. The network section will be built step by step, starting with the hardware layer and working up the network stack to arrive at the most common abstractions in computer science. The security section will present the most common attacks on networks and how to protect against and detect them.

Objectives

- Understand how the different network layers work (transmission and modulation, sockets, TCP/IP/Ethernet, etc.)
- Understand the most common methods of attack and how to detect and protect against them.

Teaching hours

Lectures	Lecture	25.5
Lab	Practical work	36

Mandatory prerequisites

INFO501

Course outline

1. Physical layer and data link (Layers 1 and 2)
2. Network layer (layer 3, IP and addressing)
3. Transport layer (layer 4, TCP/UDP, sockets)
4. Application layer (HTTP, other protocols)
5. Network security (common attacks and prevention)

Targeted skills

- Be able to use the relevant tools according to the level in the layers where the student will be working
- Understand how the OSI stack and each of its layers work
- Be able to recognize cyberattacks and know how to protect against them

Bibliography

Computer Networking: A Top-Down Approach (Kurose and Ross)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)

Project-Based Learning (PROJ741_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

Project-based learning (PBL) in the SNI specialization consists of developing the skills targeted by the academic program in engineering students by placing them in authentic situations, similar to those they may encounter in their professional lives, in attractive and motivating topics of the future:

- Smart Buildings (SB) and Connected Objects (CO)
- Renewable Energy Management (REM): photovoltaic, wind turbine, tidal turbine
- Imaging for the environment (IE)
- Service Robotics (SR): computer processing
- Health (H)

These themes are the common thread running through APP activities, which are spread over three to five semesters at a rate of one module per semester (36-hour module in semesters 6, 7, and 9; 60-hour module in semester 8). The work is carried out in teams (between four and seven engineering students) throughout the semesters.

Objectives

At the end of this module, students will be able to:

- organize work into tasks
- distribute tasks among team members
- organize and lead a work meeting
- position themselves in relation to the team in terms of skills

- develop by acquiring or developing new skills
- conduct bibliographic research in a new field
- list the knowledge and concepts useful to a project and identify those that need to be acquired
- seek external information and experiences that could contribute to the progress of the project
- approach the modeling of the system, process, or application to be developed

Teaching hours

PROJ	Project	18
PTUT	Supervised project	6 p.m

Mandatory prerequisites

PROJ641_SNI

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Lionel Valet

+33 4 50 09 65 25
Lionel.Valet@univ-savoie.fr

Course coordinator Jean-Jacques Curtelin +33 4 50 09 65 47
Jean-Jacques.Curtelin@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Embedded Systems and Concurrent Programming (INFO741_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French, English **Teaching methods:** In person **Open to exchange students:** Yes

ERASMUS reference: Engineering and related techniques

Overview

Description

This module covers the operation of embedded systems running on an operating system. It also presents the constraints associated with real-time and multitasking issues. Finally, this course addresses the implementation of a real-time, multitasking embedded system based on specifications.

Objectives

Perform multitasking programming using MUTEX objects (locks, semaphores, conditional variables)

Implement a complex real-time, multitasking system on a Raspberry Pi running a Linux OS based on specifications

Teaching hours

Lectures	Lecture	9
Tutorial	Tutorials	3
Lab	Practical work	24

Mandatory prerequisites

INFO501: Numbering and Algorithms

INFO741: Embedded Systems - Operating Systems

Course outline

1. Embedded systems operation: programmable circuit architecture, development tools
2. Real-time processing: constraints, priority order (interrupt-driven operation), adapting multitasking programming to real time
3. Developing a real-time application on an embedded system: using the Raspberry Pi platform (with embedded Linux), developing the application, testing and validation, communication with Arduino

Targeted skills

Specify, analyze, design, and implement computer systems, particularly embedded systems and communication systems (proficiency)

- by integrating interactions between the application and software and hardware architectures
- by adopting a systems approach
- by focusing on intelligent instrumentation and communicating objects

Bibliography

https://hpc-tutorials.llnl.gov/posix/

http://www.yolinux.com/TUTORIALS/LinuxTutorialPosixThreads.html

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Guillaume Ginolhac
+33 4 50 09 65 83
Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE801 Bridge to the professional world

ECTS
6 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Integrated QSE (Quality, Safety, Environment) Management System	MODULE	9 hours	10.5		
Management techniques	MODULE	18	7.5		

	Nature	Lecture	Tutorial	Practical	Credits
English (TOEIC level not achieved) S8	MODULE		40.5		
Modern languages (TOEIC level achieved)	MODULE				
English S8 Modern language 2	SUBJECT CHOICE		3 p.m.		
German TD	SUBJECT		3 p.m.		
Spanish TD Italian	SUBJECT		3:00		
TD Japanese TD	SUBJECT		p.m.		
Chinese TD Russian	SUBJECT		3:00		
TD	SUBJECT		p.m.		
Advanced English S6	SUBJECT		3:00		
	SUBJECT		p.m.		
			3:00		
			p.m.		
			3:00		
			p.m.		
			9:00		
			p.m.		

	Nature	CM	Tutorial	Practical	Credits
Optional internship S8	MODULE				
Support (half of the Thursday afternoons when FISA staff are present)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Integrated QSE (Quality, Safety, Environment) Management System (SHES802_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Overview

Description

Students must be aware that quality, environmental, and occupational health and safety management systems are now essential in business. They must therefore have sufficient knowledge of these systems in order to take them into account and integrate them into their engineering work.

Objectives

- Understand the concepts and requirements of quality management (ISO 9001), safety (ISO 45001), and environmental (ISO 14001) standards.
- Learn how to implement an integrated QSE management system tailored to the specific structure and needs of an organization.
- Acquire the skills necessary to identify, assess, and manage risks related to quality, safety, and the environment.
- Explore auditing and monitoring techniques to ensure compliance and continuously improve the integrated management system.

Teaching hours

CM		Lecture	9
Tutorial		Tutorials	10.5

Mandatory prerequisites

None

Course outline

Topic 1: Quality Management

1. Introduction to quality management;
2. Standards: definition and history of quality, principles of certification;
3. Continuous Improvement: Kaizen, 5S, Lean, Six Sigma;
4. Process Approach;
5. Tutorial: Computer modeling of a process, BPM, web publishing. Theme 2: Environmental Management

1. The environment, sustainable development, carbon footprint;
2. What is an EMS?
3. Standards, challenges;
4. The ISO 14001 standard;
5. The EMAS standard;
6. Implementing an EMS;
7. Tutorial: Audit of a company's EMS, proposal for eco-cards. Theme 3: Health and Safety at Work:

1. General information and challenges;
2. Stakeholders;
3. Legislation and OHS management system standards;
4. OHS and CSR

Targeted skills

- Ability to interpret and apply quality, safety, and environmental management standards.
- Ability to design and implement an integrated QSE management system within an organization.
- Skills in risk management and QSE performance assessment.
- Mastery of audit and monitoring techniques to ensure compliance and continuous improvement.

Bibliography

Charvet, Denis. *Integration of management systems: Quality, Safety, Environment.* Paris, AFNOR, 2019. Pignal, François, and Pierre-Emmanuel Bardin. *The QSE manual: Quality, Safety, Environment.* Paris, Dunod, 2020. Bourgoin, Alain. *The ISO 9001 standard version 2015 in 50 questions.* Paris, AFNOR, 2018.

Baril, Pierre. *ISO 14001:2015 - Understanding and implementing an environmental management system.* Paris, AFNOR, 2017.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Elodie Gardet

+33 4 50 09 24 51

Elodie.Gardet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Management Techniques (SHES803_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

Presentation

Description

This component of SHES is divided into two independent courses: Management and Ethics. The aim of this module is to understand the human and communicational dimensions of management and to develop students' managerial assertiveness.

Objectives

- Develop managerial assertiveness
- Manage a team responsible for implementing a project
- Understand the tasks and professional skills involved in implementing the project
- Know how to take a step back from complex situations and arbitrate conflicting needs related to project design
- Adopt an ethical and responsible management style

Teaching hours

Lectures		Lecture	18
Tutorial		Tutorials	7.5

Mandatory prerequisites

None

Course outline

Topic 1: Team management

- Understanding - The human dimension of management
- Communicate - The relational dimension of management

Theme 2: Ethics and psychosocial risks (PSRs)

- Mental load and information overload
- Work stress and burnout
- Harassment (moral and sexual)

To supplement this topic on psychosocial risks, students also have access to an e-learning training platform provided by INRS. This leads to the award of a certificate of completion if 66% of the students' answers are correct.

Targeted skills

- Be able to express expectations and needs. Know how to communicate ideas clearly.
- Adopt active listening and establish positive professional relationships
- Ability to analyze complex situations, evaluate available options, and make informed decisions based on organizational objectives.
- Know how to recruit, train, and develop team members, mobilize them around common goals, and foster a collaborative and productive work environment.
- Be able to identify, analyze, and solve problems encountered in the workplace using appropriate methods and tools.

Bibliography

Peretti, Jean-Marie, and Patrick Gilbert. *Management Styles: Choosing, Developing, and Implementing.* Paris, Dunod, 2014. Blanchard, Kenneth H., and Spencer Johnson. *The Management of Happiness.* Paris,

Éditions d'Organisation, 2019.

Goleman, Daniel. *Leadership: The Power of Emotional Intelligence.* Paris, Harvard Business Review Press, 2017.

Lecomte, Jacques. *Benevolent Management: What We Gain by Recognizing the Value of Others.* Paris, Odile Jacob, 2017.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Elodie Gardet

+33 4 50 09 24 51

Elodie.Gardet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

English (TOEIC level not achieved) S8 (LANG801_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

This course prepares students for the TOEIC ("Test of English for International Communication") exam, specifically to obtain a minimum score of 785 points (out of 990).

The TOEIC test will take place at the end of this semester at each of the sites on very similar dates. (Make-up sessions will take place in week 9).

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam, depending on the semester.

Objectives

Specific objectives: at the end of this course, students will be able to:

continue practicing TOEIC exercises (4 parts of listening comprehension) + entire tests

work on a variety of audio and video materials (general English, business English, and specialized English) and speak spontaneously in an interactive manner with the class

speak in a prepared manner and interact spontaneously through scientific presentations and on topics or issues related to the business world (job interviews, negotiations, discussions on technical/professional projects, wage inequality, international mobility, etc.)

Specific objectives: at the end of this course, students will be able to:

continue grammatical revision on: the conditional tense; all other tenses; expressing suggestions and modality/the passive voice; verbal structures (infinitive/ing)

improve their grammatical and lexical knowledge (general English, business English, and English specific to their scientific field), both in class and independently, validating their progress through regular tests.

Teaching hours

Tutorials	Tutorials	40.5

Mandatory prerequisites

LANG 701

Course outline

Course outline

1. **Review of important grammar points for the TOEIC**
    1. Review of all tenses covered or reviewed in S5, S6, and S7.
    2. The passive voice.
    3. Causative structures.
    4. BV / BVing or to BV.
    5. Linking words.
2. **Listening comprehension**
    1. Recorded dialogues in American, British, and New Zealand English.
    2. Videos in American, British, Australian English, etc.
3. **Reading comprehension**
    1. Press excerpts
    2. Various texts

Bibliography

Documents provided by Global Exam speakers

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern Languages (TOEIC Level Achieved) (LANG802_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	CM	Tutorial	Practical	Credits
English S8	SUBJECT		15		
Modern Language 2	CHOICE				
German TD Spanish	SUBJECT		3:00		
TD Italian TD	SUBJECT		p.m.		
Japanese TD	SUBJECT		3:00		
Chinese TD Russian	SUBJECT		p.m.		
TD	SUBJECT		3:00		
Advanced English S6	SUBJECT		p.m.		
	SUBJECT		3:00		
	SUBJECT		p.m.		
	SUBJECT		3:00		
			p.m.		
			3:00		
			p.m.		
			9:00		
			p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

English S8 (LANG802_PACYM1)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

This course focuses on acquiring professional English skills. Students will work on developing their fluency in the five skills (group project). Students will develop their skills through the study of specific topics and/or develop their intercultural knowledge.

Students will be assessed throughout the semester.

Objectives

The objective is to improve students' autonomy in the English-speaking workplace in an international context.

Teaching hours

Tutorials	Tutorials	15

Mandatory prerequisites

TOEIC score of at least 785 and Lang701 or 702

Course outline

Various presentations by professionals, mainly English-speaking teachers or external speakers

Targeted skills

Communicate independently, both orally and in writing, in all situations in a professional setting.

Bibliography

A variety of authentic materials provided by the speakers and/or students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern language 2

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
German TD Spanish	SUBJECT		3 p.m.		
TD Italian TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Chinese TD Russian	SUBJECT		3 p.m.		
TD	SUBJECT		3 p.m.		
Advanced English S6	SUBJECT		3 p.m.		
	SUBJECT		9:00 p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

Optional internship S8 (PROJ800_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The optional internship aims to enrich students' academic and professional experience by offering them a practical opportunity to apply their knowledge and acquire new skills. An optional internship can be carried out **in France or abroad**. It must comply with the same general conditions as compulsory internships.

Objectives

- **Acquisition of** specific skills related to the specialization;
- **Refining career goals and/or** gaining confidence and independence through the completion of a project or specific tasks;
- Establish valuable professional contacts that can help in future job searches.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course Director, Polytech Business Relations

Relations-Entreprises.Polytech@univ-savoie.fr

Places

Annecy-le-Vieux (74)

Support (half of Thursday afternoons when FISA volunteers are present (ACCO801_PACY)

Polytech Annecy-Chambéry
component

In brief

Teaching methods: In person **Teaching format:** Tutored project **Open to exchange students:** Yes

Presentation

Description

This support is open to all students at the school: students, apprentices, and Continuing Education employees. It is not mandatory, as it is primarily intended for students who need it to succeed in their training. This semester, it is scheduled into the timetable for each course, with a total of 16 hours.

Support may take the form of refresher courses, upgrading courses, or support in the main areas of the training programs.

Peer tutoring is encouraged and the educational resources of the Polytech Network are used (https://eplanet.polytech-reseau.org/).

Objectives

To promote the success of all students in their educational journey.

Teaching hours

PTUT	Tutored project	16

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Director of Training, Polytech

Locations

Annecy-le-Vieux (74)

Le Bourget-du-Lac (73)

UE802 Internship

ECTS
6 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Assistant Engineer Internship S8	MODULE				

Practical information

Location

Annecy-le-Vieux (74)

S8 Assistant Engineer Internship (PROJ801_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

This is a professional internship as a technician or assistant engineer. The internship is to be carried out in a company or research organization on a topic closely related to the student's area of expertise, on a full-time basis and with a **maximum of 50% teleworking**.

Objectives

This internship, carried out within a company or organization whose activity is representative of the specialty chosen at the school, should enable students to:

- Integrate and participate in a professional organization;
- Discover professional methods and practices;
- Apply the student's theoretical and practical knowledge;
- Carry out tasks similar to those of a technician or assistant engineer.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course Director, Polytech Business Relations

Relations-Entreprises.Polytech@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE803 Instrumentation and System Control

ECTS
10 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Type	Lectures	Tutorial	Practical	Credits
Decentralized automation	MODULE			24	
Experimental physics, measurements, sensors, and instrumentation	MODULE	16 hours	13.5 hours	52	
Discrete event system models and applications	MODULE	9	19.5	12	

Practical information

Locations

Annecy-le-Vieux (74)

Decentralized Automation (EASI843_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person **Type of instruction:** Practical work **Open to exchange students:** Yes

ERASMUS reference: Engineering and related techniques

Presentation

Description

From production lines to energy management in homes, automated systems are numerous and varied. Since automation has been implemented using computers, their architectures have evolved significantly, shifting from centralized to decentralized systems.

This course covers the basic elements necessary for implementing automated systems in a decentralized solution context: the control part is distributed across different processing units, offering task distribution but coordinated by communication networks.

Objectives

Upon completion of this course, students will be able to:

- distinguish and choose between centralized and decentralized control solutions and understand their respective advantages/disadvantages
- understand the steps involved in decentralization in the process of developing a control solution (definition of a communication architecture, distribution of functionalities, definition of flows and choice of associated cooperation modes, choice of corresponding network services)

- organize the control solution for a decentralized automation system of modest complexity, adopting a modular approach to the processing of operating modes and communications and prioritizing processing
- implement a decentralized control solution of modest complexity

Teaching hours

Practical work	Practical work	24

Mandatory prerequisites

Have the necessary foundations for modeling, analyzing, controlling, and implementing automated systems in a centralized solution context:

- knowledge of the architecture of an automated system, including instrumentation, control, and human/machine interface
- know how to model the functional, technological, and operational specifications of an automated system control system based on its specifications
- understand the organization of a centralized automation control solution, adopting modular operating modes and process hierarchies

Course outline

For two teams of 4 to 6 students, the 24 hours of practical work are organized around the implementation of decentralized control for an automation project:

- centralized and decentralized automation: the concept, advantages/disadvantages
- functional specifications for the control system and its decentralized hardware support (instrumentation, actuators, HMI)
- getting to grips with Ethernet communication between PLCs: configuration, producer/consumer and client/server network services
- analysis of specifications for the distribution of functionalities across different PLCs and definition of the resulting communication information and choice of appropriate communication services
- modular implementation of communication
- Modular and hierarchical organization of the control system
- implementation of the control system
- presentation and review

Skills acquired

Macro-skill	Micro-skills

Practical information

Contacts

Course coordinator Michel Cuny
+33 4 50 09 66 20
Michel.Cuny@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Experimental Physics, Measurements, Sensors, and Instrumentation (PACI841_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person **Open to exchange students:** Yes **ERASMUS reference:** Physical sciences

Presentation

Description

The objective of this course is to learn how to choose a sensor for a given application. To this end, the module covers concepts in metrology, describes the operating principles of the main types of sensors and the associated conditioning electronics, as well as the physical phenomena involved. The module consists of lectures, tutorials, practical work, and projects that allow students to deepen and apply the knowledge covered in these areas during the course.

Objectives

Identify the classes of active materials used in different applications Understand different physical principles of transduction

Evaluate the performance of the measuring device, including the sensor

Design a sensor and its packaging according to a given set of specifications

Present work carried out in a rigorous manner

Teaching hours

Lectures	Lecture	16
Tutorial	Tutorials	13.5
Lab	Practical Work	52
PTUT	Supervised project	12
PROJ	Project	4

Mandatory prerequisites

Have completed the modules and assimilated the knowledge of EASI501, PHYS541, PHYS542, PACI641, PACI642, and PACI741.

Course outline

1. **Metrology and Sensors**
   1. Definitions
   2. Measurable quantities
   3. Metrological characteristics
2. **Physical principles of sensors**
   1. Optical transducers
   2. Thermal transducers
   3. Magnetic transducers
   4. Mechanical transducers
3. **Sensor conditioning electronics**
   1. Passive sensors
   2. Wheatstone bridge
   3. Impedance bridges
   4. Active sensors
   5. Acquisition chain structures
   6. Common mode rejection
4. **Sensor study**
   1. Sensors for mechanical quantities: acceleration, velocity, force, position, and displacement
   2. Fluid sensors: pressure, velocity, flow rate
   3. Sensors for thermal quantities
   4. Optical sensors
   5. Micro-sensors

Additional information

N/A

Bibliography

- Georges ASCH, Sensors in Industrial Instrumentation, DUNOD
- Experimental physics: optics, fluid mechanics, waves, and thermodynamics: experiments M. Fruchart, P. Lidon, E. Thibierge, M. Champion, A. Le Diffon De Boeck supérieur, 2016
- R. PALLAS-ARENY and J.G. WEBSTER, Sensors and Signal Conditioning, Wiley Interscience
- P.P.L. REGTIEN, Measurement Science for Engineers, Kogan Page Science

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Michelle Passard

+33 4 50 09 66 01

Michelle.Passard@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Discrete Event Systems Models and Applications (EASI844_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In-person
Open to exchange students: Yes
ERASMUS reference: Engineering and related techniques

Presentation

Description

The aim of this course is to introduce the concepts of discrete event systems, their various models, and the benefits of these models (communication, dimensioning, verification, simulation, prediction, supervision, etc.). We will focus not only on various mathematical models of such a system, but also on modeling its inputs in order to predict the future states and outputs of the system based on its current state and available inputs. Analytical and learning approaches will also be covered.

Objectives

Choose an appropriate type of SED model from a given system and for a given question relating to expected operation.

Establish, for a given system model and a given question relating to its expected operation, whether or not a target property is satisfied.

Teaching hours

Lectures		Lecture	9
Tutorial		Tutorials	19.5 hours
TP		Practical Work	12

Mandatory prerequisites

Basic concepts of in Algebra (matrices and graphs), Analysis functional de data, variables and random vectors random, Automation, Object-oriented design and programming, Software development.

Course outline

1. Discrete Event Systems, Modeling, Petri Nets
2. Timed Event Graphs, Max-Plus Algebra, Verification, Validation, and Supervision
3. Counting and Markovian processes
4. High-level models - Domain exploration - Independent learning and bibliographic work

Bibliography

Cassandras, C.G. and Lafortune, S., Introduction to Discrete Event Systems, Springer, 2008, 772 p. (ISBN 978-0-387-33332-8 and 0-387-33332-0, read online [archive])

Annie Choquet-Geniet, Petri Networks: A Modeling Tool, Paris Éditions Dunod, coll. "Sciences Sup," March 7, 2006, 240 p. (ISBN 2-10-049147-4)

Planning with deadlines in stochastic domains | Proceedings of the eleventh national conference on Artificial intelligence [archive], on dl.acm.org (accessed March 19, 2020)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Abdourrahmane
Atto +33 4 50 09 65 27
Abdourrahmane.Atto@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE804 Information Processing and Project-Based Learning

ECTS
8 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	CM	Tutorial	Practical	Credits
Image analysis and computer vision Project-based learning	MODULE	15 hours	13.5 hours	12	
Project Information processing	MODULE				
	MODULE				
				24	

Practical information

Locations

Annecy-le-Vieux (74)

Image Analysis and Computer Vision (EASI842_SNI)

Polytech Annecy-Chambéry component

Spring

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes **Capacity:** 30

ERASMUS reference: Engineering and related techniques

Overview

Description

Through this course, students deepen their initial knowledge of image processing introduced in EASI642 and the concepts of random signals (EASI742) acquired in the one-dimensional case. It consists of two parts: the first is dedicated to image analysis methods (segmentation, classification, etc.) and the second to image correlation techniques for object detection and motion measurement.

Objectives

This module first introduces the basics of image processing (filtering, segmentation, classification, etc.) and then object detection and motion measurement through image correlation.

Teaching hours

Lectures	Lecture	15
Tutorial	Tutorials	13.5
Lab	Practical Work	12

Mandatory prerequisites

EASI642 - Signal and Image: Basic Operators

EASI742 - Random Signals

Course outline

I. Image Analysis:

- Segmentation (region/contours)

- Detection/Classification

- Morphological filtering

II. Image correlation

- Object detection using 2D correlation

- Motion measurement by 2D correlation

- 3D modeling (optional)

Additional information

N/A

Bibliography

E. Arnaud, Visual computing - Computer vision - Feature extraction - Points of interest. Lecture notes.
F. Cabestaing, 3D reconstruction, epipolar geometry, and stereovision. Course.
F. Cabestaing, Dense stereovision epipolar rectification. Course.
Correlates Solutions, Digital Image Correlation: Overview of Principles and Software, SEM 2009 Workshop.
A. Dehecq, 2015, Analysis of Himalayan and Alpine Glacier Dynamics Based on 40 Years of Earth Observation Data. Doctoral Thesis.

R. Fallourd, 2012, Monitoring Alpine glaciers by combining heterogeneous information: high-resolution SAR images and field measurements. Doctoral thesis.
J.P. Tarel, Introduction to object detection in images. Course.
Y. Yan, 2011, Fusion of displacement measurements from SAR images: Applications to seismo-volcanic modeling. Doctoral thesis.
B. Zitova and J. Flusser, 2003, Image registration methods: a survey. Image and Vision Computing, No. 21, pp. 977–1000

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Yajing Yan
+33 4 50 09 65 36
Yajing.Yan@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Project-based learning (PROJ841_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

Project-based learning (PBL) in the SNI specialization consists of developing the skills targeted by the academic program in engineering students by placing them in authentic situations, similar to those they may encounter in their professional lives, in attractive and motivating topics of the future:

- Smart Buildings (SB) and Connected Objects (CO)
- Renewable Energy Management (REM): photovoltaic, wind turbine, tidal turbine
- Imaging for the environment (IE)
- Service Robotics (SR): computer processing
- Health (H)

These themes are the common thread running through APP activities, which are spread over three to five semesters at a rate of one module per semester (36-hour module in semesters 6, 7, and 9; 60-hour module in semester 8). The work is carried out in teams (between four and seven engineering students) throughout the semesters.

Objectives

At the end of this module, students will be able to:

- organize work into tasks
- distribute tasks among team members
- organize and lead a work meeting
- position themselves in relation to the team in terms of skills

- develop by acquiring or developing new skills
- conduct bibliographic research in a new field
- list the knowledge and concepts useful to a project and identify those that need to be acquired
- seek external information and experiences that could contribute to the progress of the project
- approach the modeling of the system, process, or application to be developed

Teaching hours

PTUT	Tutored project	10
PROJ	Project	30

Mandatory prerequisites

PROJ741_SNI

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Lionel Valet

+33 4 50 09 65 25
Lionel.Valet@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Project Information Processing (PROJ842_SNI)

Polytech Annecy-Chambéry

Time of year Spring

In brief

Languages of instruction: French **Teaching methods:** In person

Teaching format: Practical work **Open to exchange students:** Yes

Presentation

Description

The objective of this module is to develop an application for processing information (images) on an embedded system.

This project will therefore combine several skills: those acquired in information processing (particularly image processing and AI), those acquired in programming, and those acquired in embedded systems. The projects will be carried out in groups (typically 5 students). They will comprise four aspects:

- the creation of an image processing program that performs facial recognition based on a machine learning algorithm
- implementing the program on an embedded system
- working in "project management" mode using methods (V, agile, etc.) and tools (planning, collaborative spaces, version management)

Objectives

The objective of this module is to apply image processing and machine learning algorithms for face recognition and then implement them on an embedded system.

Teaching hours

Practical	Practical work	24

Mandatory prerequisites

This project requires prerequisites in information processing (image processing in particular) and programming. Typically, these prerequisites correspond to the following modules:

- EASI642 - Signals and Images: Basic Operators
- EASI741 - Random Signals
- EASI842 - Image Analysis and Computer Vision
- INfO501 - Numbering and Algorithms
- INFO743 - Networks and Distributed Systems
- Embedded Systems I and II

Course outline

This project module consists of sessions scheduled in the timetable (24 hours) and supervised by project tutors, as well as independent work. The module is organized as follows:

- 3 four-hour sessions presenting the necessary knowledge
- 3.5 sessions of team work
- 1/2 session for assessment (report, oral presentation and team demonstration, and individual interviews to assess the skills acquired)

Additional information

Module on data processing and embedded systems

Bibliography

Machine learning algorithms: https://scikit-learn.org/stable/

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Guillaume Ginolhac
+33 4 50 09 65 83
Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE901 Bridge to the professional world

ECTS
10 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	CM	Tutorial	Practical work	Credits
Research and Development Project	MODULE				

	Type	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved) S9	MODULE		40.5		
Modern languages (TOEIC level achieved)	MODULE				
English S9 Modern language 2	SUBJECT CHOICE		3 p.m.		
German TD	SUBJECT		3 p.m.		
Spanish TD Italian	SUBJECT		3 p.m.		
TD Japanese TD	SUBJECT		3 p.m.		
Chinese TD Russian	SUBJECT		3 p.m.		
TD	SUBJECT		3 p.m.		
Advanced English S9	SUBJECT		3 p.m.		
	SUBJECT		9 p.m.		

	Nature	CM	Tutorial	Practical	Credits
Optional internship S9	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Research and Development Project (PROJ901_PACY)

Polytech Annecy-Chambéry
Component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The Research and Development Project (PRD) is an educational activity involving a partnership between the PAC School and a professional organization or research laboratory.
This activity allows students to acquire (or strengthen) their experience in research and development.

Objectives

The PRD aims to strengthen engineering students' R&D skills by enabling them to

- carry out and manage a research and development project in an industrial or research context,
- apply and expand the skills acquired during their training in their specializations
- solve problems while taking into account constraints such as cost, deadlines, quality, etc.
- interact within a team,
- organize themselves to achieve set objectives by planning the various stages,
- effectively monitor progress.

Teaching hours

PTUT	Tutored project	15
PROJ	Project	125 hours

Mandatory prerequisites

First year of the engineering program (FI3) for all specializations

Course outline

The first sessions are supervised by teaching and scientific tutors.

Students carry out bibliographic research, analysis, and synthesis work, partly independently.

Supervisors agree on regular meetings to review progress and provide the best possible support for students in completing their projects.

Bibliography

Depends on the R&D topic

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Nirina Chhay

+33 4 79 75 88 93

Nirina.Chhay@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

English (TOEIC level not achieved) S9 (LANG901_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

This course prepares students for their entry into professional life. Conducting or participating in a meeting: vocabulary and structures related to this aspect while continuing to work on the four skills, but with an emphasis on realistic scenarios (role-playing, acquisition of technical vocabulary (depending on the site) and business vocabulary, etc.). But also public speaking through presentations given by students in groups and/or individually, on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate). Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam.

Objectives

Specific objectives: at the end of this course, students will be able to:

Continue lexical and grammatical revisions focusing specifically on the areas tested in the TOEIC. Intensify training on TOEIC exercises (7 parts) / entire tests.

Specific objectives: at the end of this course, students will be able to:

listen regularly to news on English-language news sites (CNN, BBC, Sky News, etc.) and be able to succinctly summarize the main points orally, interacting with the class group

conduct research (in groups and individually) to develop an innovative (professional/cultural) project as a team, to be presented in class, after anticipating and simulating the steps involved with economic actors capable of helping the team to develop it, according to the stages of a credible business plan: writing emails, telephone interviews, recruitment, fundraising, etc.

present the collective project.

Teaching hours

Tutorials	Tutorials	40.5

Mandatory prerequisites

LV 801

Course outline

1. **Use of structures, vocabulary, concepts, and functions necessary for effective oral and written expression:**
    1. Tenses
    2. Questioning (in a professional context)
    3. Connecting words
2. **Listening comprehension:**
    1. Recorded dialogues in American, British, and New Zealand English...
    2. Videos in American, British, Australian English, etc.
3. **Reading comprehension:**
    1. Press excerpts
    2. Various texts

Bibliography

- Documents distributed by speakers
- Various websites, a list of which is provided at the beginning of S5
- Global Exam

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern Languages (TOEIC Level Achieved) (LANG902_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
English S9	SUBJECT		15		
Modern Language 2	CHOICE				
German TD Spanish	SUBJECT		3:00		
TD Italian TD	SUBJECT		p.m.		
Japanese TD	SUBJECT		3:00		
Chinese TD Russian	SUBJECT		p.m.		
TD	SUBJECT		3:00		
Advanced English S9	SUBJECT		p.m.		
	SUBJECT		3:00		
	SUBJECT		p.m.		
	SUBJECT		3:00		
			p.m.		
			3:00		
			p.m.		
			9:00		
			p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

English S9 (LANG902_PACYM1)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

Simulated job application followed by a job interview in English

Objectives

Become confident in face-to-face or telephone job interviews

Teaching hours

Tutorial	Tutorials	15

Mandatory prerequisites

Validated TOEIC with a minimum score of 785 and validated semester 802

Course outline

Writing resumes and cover letters, telephone interviews, and mock job interviews

Targeted skills

Communicate independently in job interviews

Bibliography

Various documents provided by instructors and students as needed

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Modern language 2

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	CM	Tutorial	Practical	Credits
German TD Spanish	SUBJECT		3 p.m.		
TD Italian TD	SUBJECT		3 p.m.		
Japanese TD	SUBJECT		3 p.m.		
Chinese TD Russian	SUBJECT		3 p.m.		
TD	SUBJECT		3 p.m.		
Advanced English S9	SUBJECT		3 p.m.		
	SUBJECT		9:00 p.m.		

Practical information

Locations

Annecy-le-Vieux (74)

Advanced English S9 (ENGL902_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: English, French **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course is a training course in professional English. Students will work on their fluency in the five language skills by enriching their technical and professional vocabulary, through role-playing, cultural contributions, and written exercises (different topics from 602, 702, and 802).

Activities will be carried out individually, in pairs, and/or in groups. Students will be assessed throughout the semester.

Objectives

The objective is to improve students' autonomy in the English-speaking workplace in an international context.

Teaching hours

Tutorials	Tutorials	21

Mandatory prerequisites

Minimum TOEIC score of 785 – Semester 801 and/or 802 completed

Course outline

Various presentations by professionals, mainly English-speaking teachers or external speakers.

Targeted skills

Communicate independently, both orally and in writing, in all situations in a professional setting.

Bibliography

A variety of authentic materials provided by instructors and/or students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Optional internship S9 (PROJ900_PACY)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The optional internship aims to enrich students' academic and professional experience by offering them a practical opportunity to apply their knowledge and acquire new skills. An optional internship can be carried out **in France or abroad**. It must comply with the same general conditions as compulsory internships.

Objectives

- **Acquisition of** specific skills related to the specialization;
- **Refining career goals and/or** gaining confidence and independence through the completion of a project or specific tasks;
- Establish valuable professional contacts that can help in future job searches.

Skills acquired

Macro-skills	Micro-skills

Practical information

Contacts

Polytech Business Relations

Relations-Entreprises.Polytech@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE902 Automation and Project-Based Learning

ECTS
7 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Automatic state approach: representation, control, and observation	MODULE	25.5 hours	25.5 hours	20 hours	
Project-based learning	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Automatic state approach: representation, control, and observation (EASI943_SNI)

Polytech Annecy-Chambéry
component

In

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

ERASMUS reference: Engineering and related techniques

Presentation

Description

At the end of this module, students will be able to represent continuous or sampled multivariable linear systems in the form of a state representation. They will also be able to analyze the properties of such systems (stability, controllability, observability) and control them using state feedback control. State observation, observer synthesis (LUENBERGER), and the implementation of state feedback control with observers are also covered.

Objectives

Master the state representation of continuous and sampled multivariable linear systems and the analysis of such systems (stability, controllability, observability).

Understand the principle of state feedback control and know how to calculate such controls.

Be able to synthesize a state observer and use it in the implementation of state feedback control.

Teaching hours

Lectures	Lecture	25.5
Tutorial	Tutorials	25.5
Lab	Practical work	20

Mandatory prerequisites

EASI641 (Signals and Systems)

EASI744 (Automatic Control: Stability and Control of Systems)

Course outline

Part 1: Representation, Control

1. Introduction

2. State Representation

2.1. State Model

2.2. Evolution equation

2.3. Block Associations

2.4. Transition from the state approach to the transfer approach (transfer function or matrix)

2.5. State representation of discrete-time systems

3. Analysis of a state model

3.1. Stability

3.2. Static gain

3.3. Controllability

3.4. Observability

3.5. Example

3.6. Concept of minimal realization

3.7. Zeros of a system in state representation

4. State feedback control

4.1. Principle

4.2. Application to a single-variable system

4.3. Decoupling and stabilizing control (multivariable systems).

Part 2: State observation

1. Assumptions and objectives

2. Luenberger observer

2.1. Continuous time

2.2. Discrete time

2.3. Luenberger observer and additive disturbance

3. Extended Observers

3.1. Constant disturbance

3.2. Ramp disturbance

4. State feedback control with observer

4.1. State feedback control

4.2. The separation principle

Additional information

None.

Bibliography

"Automation - Linear, nonlinear, continuous-time, discrete-time systems, state representation," Yves GRANJON, 4th edition, 2021, DUNOD.

"Automation - Control and Diagnosis of Dynamic Systems - Modeling, Analysis, PID and State Feedback Control, Diagnosis," Rosario TOSCANO, 2011, TECHNOSUP.

"Control of linear systems," Philippe DE LARMINAT, 2002, LAVOISIER.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal Mouille
+33 4 50 09 65 81
Pascal.Mouille@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Project-based learning (PROJ943_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

Project-based learning (PBL) in the SNI specialization consists of developing the skills targeted by the academic program in engineering students by placing them in authentic situations, similar to those they may encounter in their professional lives, in attractive and motivating topics of the future:

- Smart Buildings (SB) and Connected Objects (CO)
- Renewable Energy Management (REM): photovoltaic, wind turbine, tidal turbine
- Environmental imaging (EI)
- Service Robotics (SR): computer processing
- Health (H)

These themes are the guiding principles of APP activities, which are spread over 3 to 5 semesters at a rate of one module per semester (36-hour module in semesters 6, 7, and 9; 60-hour module in semester 8). The work is carried out in teams (between 4 and 7 engineering students) throughout the semesters.

Objectives

At the end of this module, students will be able to:

- organize work into tasks
- distribute tasks among team members
- organize and lead a work meeting
- position themselves in relation to the team in terms of skills

- develop by acquiring or developing new skills
- conduct bibliographic research in a new field
- list the knowledge and concepts useful to a project and identify those that need to be acquired
- seek external information and experiences that could contribute to the progress of the project
- approach the modeling of the system, process, or application to be developed

Teaching hours

PTUT	Supervised project	6
PROJ	Project	18

Mandatory prerequisites

PROJ841_SNI

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Lionel Valet

+33 4 50 09 65 25
Lionel.Valet@univ-savoie.fr

Course coordinator Jean-Jacques Curtelin +33 4 50 09 65 47
Jean-Jacques.Curtelin@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE903 Communicating Objects

ECTS
6 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Communicating systems, communicating sensors	MODULE			36	
Internet of Things	MODULE	3 hours	9	24	

Practical information

Locations

Annecy-le-Vieux (74)

Communicating systems, communicating sensors (EASI941_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

ERASMUS reference: Engineering and related techniques

Overview

Description

This module, carried out in the form of a mini-project in teams, aims to design and build a small network of communicating sensors. The teaching approach, which is heavily based on self-learning, allows students to acquire the prerequisites necessary for this project while developing their autonomy. Additional resources (introduction to the communication protocol to be implemented, training in computer-aided electronic design, etc.) are provided during the project.

Each team must, in particular, design and build an electronic circuit from scratch comprising a sensor, a radio communication module, and additional components, using computer-aided design tools and printed circuit board manufacturing methods. This module must minimize its energy consumption; it will be integrated into the network, which includes a central element responsible for collecting and processing information from remote sensors.

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The aim of this module, which takes the form of a mini-project in teams, is to design and build a small network of communicating sensors. The teaching approach is strongly based on self-learning, enabling students to integrate the prerequisites necessary for this project while developing their autonomy. Additional resources (introduction to the communication protocol to be used, training in computer-aided electronic design, etc.) are provided during the project.

In particular, each team has to design and build an electronic circuit from A to Z, comprising a sensor, a radio communication module and additional components, using computer-aided design tools and printed circuit manufacturing resources. This module must minimize its energy consumption; it will be integrated into the network including a central element responsible for retrieving and processing information from remote sensors.

Objectives

This module will enable engineering students to:

- Identify the necessary characteristics of a communication system (wired or wireless, speed, capacity, energy consumption, diameter, etc.).
- Choose an appropriate communication protocol.
- Program a low-power microcontroller to manage a sensor, pre-process information, and control a communication device.
- Set up and configure a network of communicating objects.

Teaching hours

Practical work	Practical work	36

Mandatory prerequisites

- EASI501_PACY: Electricity
- PHYS542_SNI: Electromagnetism Applied to Information Transmission
- INFO501_PACY: Number Systems and Algorithms
- PACI741_SNI: Instrumentation Electronics: Essential Concepts for Engineers
- INFO741_SNI: Embedded Systems
- INFO743_SNI: Networks and Distributed Systems

Course outline

Specific concepts and cultural contributions necessary for technological choices in the design of communicating sensors.

- Embedded computer systems (microcontrollers, FPGAs, PSOCs, etc.)
- Wireless communication technologies (WIFI, Zigbee, Bluetooth, etc.)
- Integrated sensors (analog or digital)
- Energy sources (batteries, ambient energy recovery)

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Renaud Gaglione
Renaud.Gaglione@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Internet of Things (INFO943_SNI)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French, English **Teaching methods:** In person **Type of instruction:** Lecture **Open to exchange students:** Yes

ERASMUS reference: Engineering and related techniques

Presentation

Description

The objective of this course is to raise students' awareness of the importance of the IoT. It introduces the fundamental concepts of the Internet of Things and describes the design chain for connected objects.

Objectives

The objective of this course is to raise students' awareness of the importance of IoT. It introduces the fundamental concepts of the Internet of Things and describes the design chain for connected objects.

Teaching hours

Lectures	Lecture	3
Tutorial	Tutorials	9
Lab	Practical work	24

Mandatory prerequisites

INFO 642, PROJ 842, PACI 841

Course outline

1. Introduction
2. The IoT market
3. Fundamental concepts
4. Interactions between the "digital world" and the "physical world"
5. Infrastructures for the IoT
6. Technological solutions
7. Application examples
8. 24-hour IoT project development project on the following topics (examples)
    1. Design and development of an IT equipment monitoring application
    2. Interface between a cyber-physical system and the IFTTT service

Targeted skills

Design of an end-to-end IoT system, sizing of an IoT system based on specifications.

Bibliography

Inria publishes a white white on the Internet of Internet (IoT), 2021 https://www.inria.fr/sites/default/files/2022-03/ LB_IoT_EN_WEB_BD_4.pdf

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)

UE904 Information Processing

ECTS
7 credits

Polytech Annecy-Chambéry
component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Advanced machine learning	MODULE	12h		24h	
3D imaging: acquisition, reconstruction, applications Interdisciplinary project: face recognition	MODULE	13.5h	10.5	12h 36	

Practical information

Locations

Annecy-le-Vieux (74)

Advanced Machine Learning (DATA942_SNI)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

ERASMUS reference: Information and Communication Technologies (ICT)

Overview

Description

This module, dedicated to machine/automatic/deep learning, aims to build complex models that are not necessarily analytical, based on a set of simple mathematical operators/concepts and learning data. The aim is to discover, through the data and depending on the problem to be solved (decision-making, decision support, segmentation, classification, content search based on a query, etc.), optimal functionalities capable of breaking down the data to extract significant attributes and thus lead to sophisticated processing of digital information. These functions can be very parsimonious (shallow learning) or organized into several highly complex layers (deep learning). Built on several scientific disciplines (statistics, numerical analysis, optimization, computer science, etc.) and a fundamental component of artificial intelligence, machine learning is now used in many fields of activity.

Objectives

Choose an artificial intelligence method appropriate for solving a data analysis or data search problem, then justify your choice, and finally interpret and evaluate the results obtained.

Teaching hours

Lectures	Lecture	12
Lab	Practical work	24

Mandatory prerequisites

Mastery of basic concepts in statistics, numerical analysis, optimization, computer science, digital systems, and mathematical modeling

Course outline

1. General issues
   1. Data (sets, big data, heterogeneous data, etc.)
   2. Types of set problems involving such data
   3. Formulation of a deep learning problem on a data set
2. Unsupervised learning (data sets)
   1. Direct data modeling
   2. Modeling of deep attributes extracted from data
   3. Metrics and similarity measures on categorical attributes
3. Supervised learning (datasets)
   1. Data benchmarking
   2. Non-recurrent networks (mainly CNN)
   3. Recurrent networks (LSTM and variants)
4. Openness to other approaches on data sets
   1. Reinforcement learning
   2. Overfitting and open problems
   3. Adversarial generative models

Bibliography

A.M. Atto, Deep Convolutional Neural HyperSpaces and Deep Functional Analysis, ISTE Group, https://www.istegroup.com/ fr/produit/deep-convolutional-neural-hyperspaces-and-deep-functional-analysis/

A. M. Atto, Convolutional Fractional Stochastic Fields and their Deep Learning, ISTE Group, https://www.istegroup.com/fr/ produit/convolutional-fractional-stochastic-fields-and-their-deep-learning/

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Abdourrahmane Atto
+33 4 50 09 65 27
Abdourrahmane.Atto@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

3D imaging: acquisition, reconstruction, applications (EASI942_SNI)

Polytech Annecy-Chambéry

Time of year Fall

In brief

Course start date: Sept. 30, 2024 **Languages of instruction:** French, English **Teaching methods:** In person **Open to exchange students:** Yes

ERASMUS reference: Engineering and related techniques

Overview

Description

Introduction to 3D image acquisition, reconstruction, and processing

This course mainly addresses: acquisition, reconstruction, segmentation, and analysis of 3D images acquired by means of X-ray tomography. Examples are given in the field of industrial control (non-destructive testing, materials science, etc.) as well as medical imaging.
Case studies are presented by industrialists and research engineers from the company RX-solutions or at the European Synchrotron Radiation Facility (ESRF).

A visit to the facilities of RX-solutions (an SME that manufactures tomographs) is organized in parallel with the course. The course is composed of three parts:

* physical aspects; interaction of radiation with matter
* computed tomography
* 3D image processing

Case studies are presented by industrialists and research engineers from the company RX-solution and at the ESRF. A visit to the RX-solutions facilities is organized in parallel with the course.

Course documents are in English. Lectures are given in English for non-French speaking students.

Objectives

- learn about the main techniques for surface analysis and material inspection by reflection (optical) or transmission (acoustic, electromagnetic, electronic)
- learn about the associated sensors
- Solve an inverse problem in the case of 2D and 3D reconstruction
- Choose processing and analysis operators from a library
- draw up specifications and prepare a response to a call for tenders

Teaching hours

Lectures	Lecture	13.5 hours
Tutorial	Tutorials	10.5
Lab	Practical work	12

Required prerequisites

MATH641, MATH642, EASI642, EASI842 or equivalent knowledge. Basic knowledge in material science.

Course outline

1. Which imaging technique for a given application:

- ultrasound, terahertz, X-rays, neutrons, MRI, optical techniques, SPECT, PET

2. Computed tomography:

- modeling;
- analytical techniques (Radon transform, Fourier slice theorem)
- algebraic techniques
- practical issues (spatial resolution)

3. 3D image processing:

- visualization, filtering, shape analysis

Practical work:

Qualitative and quantitative study of a tomography device

- Characterization of the effect of acquisition and reconstruction parameters on image quality
- Characterization of the effects of poor mechanical adjustment

Bibliography

P. Grangeat, Tomography, ISTE/Wiley, 2009

P. Grangeat, Tomography: Mathematical Foundations, Microscopic Imaging, and Industrial Imaging, IC2. Hermes Publishing; 2002

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Lucia Di-Ciaccio-Burkhardt
+33 4 79 75 85 85
Lucia.Burkhardt@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Interdisciplinary project: facial recognition (PROJ942_SNI)

Polytech Annecy-Chambéry

Time of year Fall

In brief

Languages of instruction: French, English **Teaching methods:** In person **Teaching format:** Tutored project **Open to exchange students:** Yes **Capacity:** 24

Presentation

Description

Development of an information processing application for tablet devices.

This project will combine several skills: those acquired in information processing (particularly image processing and vision), those acquired in design and programming, and those acquired in distributed processing. The projects will be carried out in groups (typically 5 students). They will comprise four aspects:

- the creation of an image acquisition interface (a face) on a tablet

- the implementation of an image processing program that performs face recognition based on principal component analysis or learning techniques.

- Establishing communication between the tablet and the processing server.

- Working in "project management" mode using methods (V, agile, etc.) and tools (planning, collaborative spaces, version management).

Objectives

The objective of this module is to develop an information processing application for tablet devices.

Teaching hours

Practical	Practical work	36

Mandatory prerequisites

This project requires prerequisites in information processing (image processing in particular) and programming. Typically, these prerequisites correspond to the following modules:

EASI642 - Signals and Images: Basic Operators EASI842 - Image Analysis and Computer

Vision INFO501 - Numbering and Algorithms

INFO641 - Object-Oriented Design and Programming INFO743 - Networks and Distributed

Systems

INFO742 - Software Development Methods and Quality

Course outline

This project module consists of sessions scheduled in the timetable (36 hours) and supervised by project tutors, as well as independent work.

The organization is as follows:

- 4 four-hour sessions presenting the necessary knowledge (1) tablet programming, 2) image analysis, 3) distributed systems, 4) IT project management)
- 4.5 sessions of teamwork
- 1/2 session for assessment (report, oral presentation and team demonstration, and individual interviews to assess the skills acquired)

Additional information

N/A

Bibliography

https://www.datacamp.com/tutorial/face-detection-python-opencv

https://developer.android.com/codelabs/basic-android-kotlin-compose-first-app?hl=fr#0

https://lim.univ-reunion.fr/staff/courdier/old/cours/java/Chap7_JavaNet/Chap7_JavaNet.pdf

https://www.youtube.com/watch?v=vhpcngRVE_A

https://www.youtube.com/watch?v=VWhLcgo9z74

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Yajing Yan

+33 4 50 09 65 36

Yajing.Yan@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE001 Engineering Internship

ECTS
30 credits

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French

Open to exchange students: Yes

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
S10 engineering internship	MODULE				

Practical information

Location

Annecy-le-Vieux (74)

S10 Engineering Internship (PROJ001_PACY)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French

Open to exchange students: Yes

Overview

Description

The internship must be carried out in a company or research organization related to the student's area of expertise, on a full-time basis and with a **maximum of 50% teleworking**.

Objectives

This is an internship carried out within a company or research laboratory, department, or organization whose activity is representative of the student's specialty. This internship should enable students to:

- the student to apply their theoretical and practical knowledge;
- verify their aptitude for engineering work.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course Director, Polytech Business Relations
Relations-Entreprises.Polytech@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE501 SHES - Languages

ECTS
8 credits

Polytech Annecy-Chambéry
component

List of courses

	Type	Lecture	Tutorial	Practical	Credits
Support (every Thursday afternoon)	MODULE				

	Nature	CM	Tutorial	Practical	Credits
Labor law and corporate structure 1	MODULE	8 p.m.	12:00		
Introduction to Sustainable Development and CSR - Cognitive Development English	MODULE MODULE	4 p.m.	p.m. 12:00 p.m. 37	4	

Practical information

Locations

Annecy-le-Vieux (74)

Labor Law and Corporate Structure 1 (SHES510_PACYFISA)

Polytech Annecy-Chambéry

In brief

Languages of instruction: French **Teaching methods:** In person

Open to exchange students: Yes

Presentation

Description

Common economic concepts used to characterize the economic situation of a company, their content and meaning, and understanding the distinction between economics and finance.

Concepts of labor law.

Objectives

This course aims to enable students to:	Level	At the end of this course, students will be able to:
understand the major changes in the economic world (production economy/market economy) and the elements of the business environment, their roles, and their expectations.	Master	understand the economic workings of their company and/or projects
understand the challenges facing the company and why a company must evolve,	Master	Participate in the necessary evolution of the company

both in terms of its services (adapting to demand, innovation) and its organization (cost reduction, continuous improvement)		
know the common economic terms used to describe the company's economic situation, their content, and their meaning, and know and understand the difference between economics and finance	Master	of reading an income statement and a balance sheet
		to draw up a simple provisional budget and an economic approach to an improvement measure
Have a basic understanding of labor law	Know	Knowing your rights within the company

Teaching hours

Lectures		Lecture	8 p.m
Tutorial		Tutorials	12

Mandatory prerequisites

- Have completed an internship in a company
- Knowledge of basic economic vocabulary
- Knowledge of the company, its structure, and its management

Course outline

1. Knowledge of the company
   - The economic environment (customers, suppliers, shareholders, banks, government, local authorities, social organizations, competitors, social partners, etc.)
   - Changes in the economic world and their impact on fundamental economic reasoning (market economy, globalization, etc.)
   - Customer needs, the need for innovation
   - Different possible scenarios for increasing profits
   - The concept of useful value for the customer and economic waste
2. The concept of economics
   - Definition of the main terms used in the income statement (influence of inventories, depreciation mechanism, payroll and its content, taxes, profits, availability of earnings)
   - Definition of key terms in the balance sheet (fixed assets, receivables/payables, concept of provisions and risk, financing: share capital and loans)

- The dynamics between the income statement and balance sheet (the main mechanisms, interests of the various stakeholders: shareholders, bankers, employees, etc.)
- The company's cash flow and its availability over time (VAT mechanism, depreciation, and borrowing)
- The implementation of economic indicators at the workshop level (types of indicators, limitations)
- Drawing up a simple provisional budget (principle)

3. Introduction to legislation
   - Different types of employment contracts
   - The powers of the employer
   - Working conditions
   - Remuneration for work
   - Events affecting the employment contract
   - Termination of the employment contract
   - Procedures and consequences of dismissal
   - Employee representation

Additional information

Bibliography

My small business day-to-day. From balance sheets to financial analysis: understanding, managing, analyzing Nadine BONHIVERS

BUSINESS solutions

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Véronique Saudrais

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Introduction to Sustainable Development and CSR - Cognitive Development (SHES511_PACYFISA)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: French **Teaching methods:** In person
Open to exchange students: Yes

Presentation

Description

The Cognitive Development course aims to open engineering students' minds to SHEJS and provide them with useful guidelines for advancing their projects, both personally and professionally.

The Sustainable Development section lays the foundations for ethics and CSR.

Objectives

Acquire benchmarks and tools to optimize learning

Learn the basics of corporate social responsibility and sustainable development

Teaching hours

Lectures	Lecture	16
Tutorial	Tutorials	12
Lab	Practical Work	4

Mandatory prerequisites

None

Course outline

1. Introduction to Sustainable Development

- Why companies take the environment into account in their strategy (environmental issues, industrial accident prevention, environmental regulations, etc.).
- Introduce the environmental management system (as defined by ISO 14001), its principles, organization, and benefits for businesses.
- Introduce other environmental approaches and how they fit together (energy management, carbon accounting, and eco-design). Regulatory aspects are also introduced.

2. Cognitive development.

- Understanding SHEJS and their usefulness in engineering training
- Learn how to manage a project in the broadest sense (neuroscience: plasticity and objectives, the importance of defining objectives, mental processes including memorization and the forgetting curve, etc.)
- Finding your bearings to optimize learning (neuroscience: 4 pillars of learning, role of attention, VAKOG model. .....)
- Finding your bearings to be effective (optimal conditions for brain use, identification of personality profiles—the "Brain Preferences" model—organization, identification of resources.)

Additional information

Bibliography

CSR and sustainable development: Labels, reporting, CSRD, ISO 26000, SDGs - Alain Jounot Journey Beyond My Brain - Dr. Jill Bolte Taylor

Inaugural lecture at the Collège de France "Towards a science of mental life" - Stanislas Dehaene Face to face with your brain - Stanislas Dehaene

A Day in Anna's Brain - Sylvie Chokron Cognition: Theories and Applications - Reed,

Stephen K.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sandrine Vieules-Rosset +33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

English (LANG510_PACYFISA)

Polytech Annecy-Chambéry
component

In brief

Languages of instruction: English, French **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

ERASMUS reference: Languages

Presentation

Description

This course prepares students for the TOEIC (Test of English for International Communication) exam, specifically to obtain a minimum score of 785 points (out of 990).

With the aim of developing all four skills, this course also serves as an introduction to public speaking through presentations given by students in groups or individually on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate, as well as written work).

Students are assessed throughout each semester.

Objectives

Specific objectives: at the end of this course, students will be able to:

listen regularly to news on English-language news sites (CNN, BBC, Sky News, etc.) and be able to succinctly summarize the main points orally, interacting with the class group.

work with a variety of audio and video materials and speak spontaneously in an interactive manner with the class

to speak in a prepared manner and interact spontaneously through individual presentations (self-presentation and/or article reports, such as "quizzes") and presentations in pairs (various topics)

work on telephone conversations (comprehension/production)

practice TOEIC exercises (4 parts of listening comprehension) + entire tests

Teaching hours

Tutorials	Tutorials	37

Mandatory prerequisites

CEFR level B1

Course outline

Course outline

1. **Oral**
    1. Elements of phonology
    2. Grammar (tenses, questions, adjectives.....)
    3. Reinforcement of structures and vocabulary
    4. Interactive oral communication
    5. Introduction to and practice for the TOEIC (listening section)
2. **Writing**
    1. Review of grammatical elements (tenses, questioning, adjectives. .....)
    2. Translation (theme/version)
    3. Reading comprehension in authentic language
    4. Curriculum vitae (in S5, S6, or S7 at the latest)
    5. Cover letter/letter of motivation (in S5, S6, or S7 at the latest)
    6. Introduction and training for the TOEIC (reading section)

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE502 Work experience

ECTS
4 credits

Polytech Annecy-Chambéry
component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 1 (Launch and follow-up)	MODULE	1		4	
Evolution in business	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 1 (Launch and monitoring) (PROJ501_PACYFISA)

Polytech Annecy-Chambéry
component

In brief

- **Languages of instruction:** French
- **Teaching methods:** In person
- **Teaching format:** Learning and assessment situations
- **Open to exchange students:** Yes

Presentation

Description

Understanding the host company and the expectations of the engineering profession

Take a step back to look at the integration process and the effectiveness of the company's approach to monitoring apprentices

Objectives

Identify the essential workings of the company

understand your role within your company and take a step back to view it objectively understand what is expected

of an engineer

Teaching hours

Lectures		Lecture	1
Lab		Practical work	4
Other		Other	2

Mandatory prerequisites

None

Course outline

Launch

Support: developing an action plan to ensure the success of your project

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sandrine Vieules-Rosset +33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Corporate Development (STAG501_PACYFISA)

Polytech Annecy-Chambéry
component

In brief

- **Languages of instruction:** French
- **Teaching methods:** In person
- **Teaching format:** Learning and assessment situations
- **Open to exchange students:** Yes

Presentation

Description

Analysis of the apprentice's progress during their integration into the company.

Objectives

The tasks assigned to the apprentice should enable them to discover the company.

Mandatory prerequisites

None

Course outline

An assessment carried out by the company in January.

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sandrine Vieules-Rosset +33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE503 Engineering Sciences and Tools

ECTS
18 credits

Polytech Annecy-Chambéry
component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Electricity	MODULE	13.5 hours	15h	12	
Support for skills development Algorithms and Python programming	MODULE	3	12h		
	MODULE	3	6		
				12	
Databases (business management information database) Mathematics Core Curriculum	MODULE	6 hours	4.5 hours	12 hours	
Automation	MODULE	16.5 hours	37.5 hours		
	MODULE	6			
			13.5	20	
C programming	MODULE	6	6 hours	12 hours	
Material Properties	MODULE	17h	9 a.m.	8	

Practical information

Location

Annecy-le-Vieux (74)

UE601 SHES - Languages

ECTS
4 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Introduction to sustainable development and CSR	MODULE	6 hours	4		
Sustainable development - Site approach (Environmental management)	MODULE	4	6		

	Nature	CM	Tutorial	Practical	Credits
Support (every Thursday afternoon when FISA staff are present)	MODULE				

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved)	MODULE		30 hours		
English (TOEIC level achieved)	MODULE		30 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Introduction to Sustainable Development and CSR (SHES611_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

Global warming and sustainable development Responses and

strategy

GEDES

Objectives

Acquire a foundation of knowledge and skills in ecological transition for sustainable development (TEDS)

Teaching hours

Lectures		Lectures	6
Tutorial		Tutorials	4

Mandatory prerequisites

Basic knowledge of the environment

Course outline

Understanding global warming: causes, consequences, global challenges, and implications for the industrial sector;

- Understanding the evolution of the concept of sustainable development;
- Understanding responses to the climate crisis and identifying different approaches (international agreements, legislative framework, climate strategy);
- Developing a strategic vision to integrate climate issues and the need for ecological transition for an industrial company;
- Understanding what a Greenhouse Gas Emissions Assessment (GHG EA) is;
- Understand the GHG inventory methodology and know how to carry out a GHG inventory for an industrial company;
- Identify concrete actions to reduce GHG emissions and develop an action plan based on the project approach.

Additional information

Bibliography

Global Warming John Houghton

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Claire
Roset

Course coordinator Laure
Comble

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Sustainable Development - Site Approach (Environmental Management) (SHES612_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

Energy production and environmental challenges

Objectives

Acquire a foundation of knowledge on energy issues, energy production systems, and the methodology for implementing an energy transition strategy:

Teaching hours

Lectures	Lecture	4
Tutorial	Tutorials	6

Mandatory prerequisites

Basic knowledge of the environment

Course outline

1. Understanding the main challenges of global energy production
2. Understand the current energy situation in France, energy transition scenarios, and public policies for achieving carbon neutrality;
3. Introduction to the building sector: present the different energy systems available for powering a building and understand the advantages and disadvantages of each;
4. Understanding the challenges of building regulations;
5. Understand the methodology and know the tools needed to implement an energy transition strategy for built heritage;
6. Have a basic understanding of energy transition financing.

Additional information

Bibliography

Energy Transition and Climate,

1st edition

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Claire Roset

Course coordinator Laure Comble

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

English (TOEIC level not achieved) (LANG610_PACYFISA)

Polytech Annecy-Chambéry

In brief

- **Languages of instruction:** English, French
- **Teaching methods:** In person **Teaching**
- **format:** Tutorials **Open to exchange students:**
- Yes **ERASMUS reference:** Languages
-

Presentation

Description

This course prepares students for the TOEIC ("Test of English for International Communication") exam, specifically to obtain a minimum score of 785 points (out of 990).

Students are assessed throughout each semester. The final assessment consists of a 1- or 2-hour exam.

Objectives

Specific objectives: at the end of this course, students will be able to:

work on telephone conversations (comprehension/production)

listen regularly to news on English-language news sites (CNN, BBC, Sky News, etc.) and be able to succinctly summarize the main points orally, interacting with the class

work on a variety of audio and video materials and speak spontaneously in an interactive manner with the class

speak in a prepared manner and spontaneously interact through individual presentations (self-presentation and/or article reports, such as "quizzes") and presentations in pairs (various topics)

practice TOEIC exercises (4 parts of listening comprehension) + entire tests

Teaching hours

Tutorials	Tutorials	30

Mandatory prerequisites

LANG510

Course outline

Course outline

1. **Review of important grammar points for the TOEIC**
   1. Nouns
   2. Pronouns
   3. Linking words...
2. **Listening comprehension**
   1. Recorded dialogues in American, British, and New Zealand English...
   2. Videos in American, British, and Australian English...
3. **Reading comprehension**
   1. Press excerpts
   2. Various texts

Additional information

Bibliography

Documents provided by Global Exam speakers

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

- Annecy-le-Vieux (74)

Campus

- Annecy / Annecy-le-Vieux campus

English (TOEIC level achieved) (LANG611_PACYFISA)

Polytech Annecy-Chambéry

In brief

- **Languages of instruction:** English, French
- **Teaching methods:** In person **Teaching**
- **format:** Tutorials **Open to exchange students:**
- Yes

Presentation

Description

This course prepares students for their entry into professional life. Conducting or participating in a meeting: vocabulary and structures related to this aspect while continuing to work on the four skills, but with an emphasis on realistic situations (role-playing, acquisition of technical vocabulary and business vocabulary, etc.). It also covers public speaking through presentations given by students in groups and/or individually. Students are assessed throughout the semester.

Objectives

To be and become as autonomous as possible in an industrial context in English.

Teaching hours

Tutorial hours	Tutorials	30

Mandatory prerequisites

Toeic validated with a minimum score of 785 for apprenticeship students or 600 for continuing education students and Lang510_GICM

Course outline

Various presentations by specialists in industrial and business-related fields, mainly English speakers

Additional

Targeted skills

Greater autonomy in order to communicate in all circumstances in an international setting

Bibliography

Various documents provided by the speakers and/or the students themselves.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE602 Work experience

ECTS
10 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 1 (Monitoring and reporting)	MODULE			4 hours	
Career development (4 areas)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 1 (Monitoring and reporting) (PROJ601_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** English
- **Teaching methods:** In person
- **Teaching format:** Learning and assessment situations
- **Open to exchange students:** Yes

Presentation

Description

Prepare for active participation in business projects.

Objectives

Establish the methodological foundations for problem solving and project management:

- take stock of practices in relation to projects within the company

- know how to define a project

- draw up initial specifications

Teaching hours

Practical work	Practical work	4
Other	Other	1

Mandatory prerequisites

First part in semester 5

Course outline

Workshop: managing an action plan (creation, modification, and monitoring) & Tools/Methods for project management/problem solving

Defense

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Corporate Development (4 areas) (STAG601_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This monitoring allows us to see the progress made by engineering students during the various assignments and projects carried out within the company. The semester 6 assessment relates to the first year of the work-study program.

Objectives

Knowing the company's services in order to:

- be effective,

- communicate effectively,

- demonstrate pragmatism and adaptability

Mandatory prerequisites

None

Course outline

Assessments carried out by the company

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy (74)

Campus

Annecy / Annecy-le-Vieux campus

UE603 Engineering Sciences

ECTS
16 credits

Polytech
Annecy-
Chambéry

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Instrumentation electronics: essential concepts for engineers	MODULE	12	12	12	
Embedded Systems I	MODULE	9	3	24	
Challenges of artificial intelligence	MODULE	ho			
Signals and images: basic operators	MODULE	ur s 6 ho ur s 10.5	13.5	9	
Electromagnetism and optics applied to information transmission	MODULE	22	18	20	
Signals and systems	MODULE	12 p.m.	12 p.m.	12 hours	

Practical information

Location

Annecy-le-Vieux (74)

Signal and image: basic operators (EASI642_SNIFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French, English
- **Teaching methods:** In person **Teaching**
- **format:** Lecture **Open to exchange students:**
- Yes

Presentation

Description

Based on analog signal modeling, this course aims to provide the necessary concepts for filtering and analyzing 1D and 2D digital signals. The concepts covered include:

- temporal analysis of deterministic signals
- frequency analysis of deterministic signals
- analog linear filtering
- digital signals: modeling and filtering
- 2D signals and images: representation and filtering

Objectives

This course aims to provide a general introduction to signal processing, covering the basic concepts.

Teaching hours

Lectures	Lecture	10.5
Tutorial	Tutorials	13.5 hours
Practical Work	Practical Work	9

Mandatory prerequisites

vector spaces, scalar product, integral

Course outline

1. **Representation of deterministic signals with finite energy and finite average power** (temporal and frequency analysis, filtering)
2. **Digital signals**: sampling and quantization, frequency aspects
3. **1D linear digital filtering**: frequency approach and circular convolution, time approach and RIF filtering, difference equation and RII filtering
4. **2D signals**: filtering and edge detection in images, signal and image compression; introduction to graph signals

Additional information

N/A

Bibliography

Signal Processing, Emmanuel Trouvé - Philippe Bolon

http://culturesciencesphysique.ens-lyon.fr/ressource/numerisation-acoustique-Chareyron2.xml

https://www.youtube.com/watch?v=4XCSoFLFLNE

https://glq2200.clberube.org/chapitres/docs/signal-fourier

https://www.youtube.com/watch?v=7cLmZAbRo1o
https://www.youtube.com/watch?v=fzGi84wanDU

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Yajing Yan
+33 4 50 09 65 36
Yajing.Yan@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Electromagnetism and Optics Applied to Information Transmission (PACI642_SNIFISA)

Polytech Annecy-Chambéry component

In brief

- **Teaching methods:** In person
- **Open to exchange students:** Yes

Presentation

Description

This course provides the fundamentals of geometric and wave optics necessary for understanding systems that use optical transmission. Matrix formalism and numerical simulation are used to give future engineers reliable methods for quickly and easily describing how an optical system works.

Objectives

1) describe the functioning of a geometric optical system based on its equivalent elements, using a matrix approach with the concepts of object, image, magnification, and enlargement

2) describe the polarization state of a light wave using complex notation and use matrix formalism to calculate the effect of a polarizer or retardation plate on any polarization state. Model and understand interference and diffraction phenomena and know the common applications of these phenomena

3) Describe the propagation and confinement of light in a plane guide and/or optical fiber structure

Teaching hours

Lectures	Lecture	22
Tutorial	Tutorials	18
Lab	Practical Work	8 p.m.

Mandatory prerequisites

PHYS542: Electromagnetism Applied to Information Transmission

Course outline

1. Geometric Optics (light propagation, general information on optical instruments, matrix processing)
2. Wave Optics (propagation of a pulse, the "wave" nature of light, photometry, polarization: matrix processing, applications of interference and diffraction phenomena)
3. Optical Microscopy
4. Guided optics and optical transmission

Bibliography

- Optics, Eugene Hecht, Pearson, 2005
- Optics Manual, G Chartier, Hermes, 1997
- Introduction to Matrix Methods in Optics, A Gerrard and JM Burch, Wiley 1994

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator

Yannick Mugnier

+33 4 50 09 65 16

Yannick.Mugnier@univ-savoie.fr

Location

Annecy-le-Vieux (74)

Signals and Systems (EASI641_SNIFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

At the end of this module, students will be able to represent the behavior of a linear dynamic system, in continuous time or sampled time, using a transfer function. For any system modeled by a transfer function, they will also be able to analyze its temporal behavior (index response) and frequency behavior (Bode diagram).

Objectives

Master the representation of linear dynamic systems using transfer functions (continuous time, sampled time).

Be able to analyze the behavior of a system, in both the time domain and the frequency domain, based on its transfer function.

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12
Lab	Practical Work	12

Mandatory prerequisites

Basic concepts of differential equations and recursive equations. Basic concepts and

operations involving complex numbers.

Course outline

1. Introduction

1.1. Concept of systems and variables

1.2. Concept of causality

1.3. Concept of models

1.4. Continuous time, sampled time

2. Signals

2.1. Introduction

2.2. The Laplace transform

2.3. The Z transform

3. Transfer function

3.1. Introduction

3.2. Continuous-time systems

3.3. Discrete-time systems

3.4. Sampled continuous-time systems

3.5. Representation of a system using a block diagram

4. Time and frequency analysis of continuous linear systems of order 1 and order 2

4.1. Introduction

4.2. Time analysis

4.3. Frequency analysis

4.4. First-order systems

Bibliography

"Automatique - Systèmes linéaires, non linéaires, à temps continu, à temps discret, représentation d'état" (Automation - Linear, nonlinear, continuous-time, discrete-time systems, state representation), Yves GRANJON, 4th edition, 2021, DUNOD.

"Basic Automatic Control - Lectures and Corrected Exercises," Mohamed DAROUACH, Philippe PIERROT, Michel ZASADZINSKI, 2019, ELLIPSES.

"Control of Continuous Linear Systems - Exercises and Methods," Yves GRANJON, 2022, DUNOD. "Control Theory - Linear

and Continuous Systems," Sandrine LE BALLOIS, Pascal CODRON, 2nd edition, 2006, DUNOD.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal
Mouille
+33 4 50 09 65 81
Pascal.Mouille@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE701 SHES - Languages

ECTS
8 credits

Polytech Annecy-Chambéry

List of courses

	Nature	CM	Tutorial	Practical	Credits
Support (half of Thursday afternoons when FISA staff are present)	MODULE				

	Nature	CM	Tutorial	Practical	Credits
Management	MODULE		32		
Business Structure and Entrepreneurship 2	MODULE	12 hours	12		
Sustainable development - Product approach	MODULE	4	2	8	

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level achieved)	MODULE		34 hours		
English (TOEIC level not achieved)	MODULE		34 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Management (SHES701_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This course will be divided into two parts:

- Business management
- Entrepreneurship

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
initiate a business creation process	Application	learn the basics of business management
		list the questions that a future entrepreneur must ask themselves
		adopt an approach that can lead to business creation
to carry out an economic project in your business	Application	have a macroeconomic vision of the company

		be familiar with all the financial aspects of putting together a business plan
		to use economic language

Teaching hours

Tutorials	Tutorials	32

Mandatory prerequisites

Basic understanding of how a business

operates Basic understanding of economics

Course outline

1. General accounting: the core of the accounting information system
   - Presentation of the accounting information system
   - Presentation and functioning of the balance sheet
   - Presentation and functioning of the income statement
   - Introduction to financial analysis
2. Budget management: forecasting, anticipating, and decision-making
   - Initial budgets
   - Cash flow budget
   - Provisional balance sheet and income statement
3. Cost calculation methods: analyzing data provided by general accounting
   - Full cost calculation
   - Partial cost calculation
4. Investment project analysis
   - Analysis of investment profitability
   - Financing methods and their implications
5. Entrepreneurship
   - The various stages, approaches, and steps to be taken before deciding to start a business
   - The business plan (its structure and components)
   - Existing tools

Additional information

Bibliography

Management accounting

Large Format - 08/21/2018 - GUALINO

Grandguillot F., Grandguillot B.

Entrepreneurship

Léger-Jarniou Catherine

Collection: Openbook

Format: Paperback

317 pages

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pierre Thabuis
+33 4 79 75 85 85
Pierre.Thabuis@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Business Structure and Entrepreneurship 2 (SHES702_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

The entire program is structured around:

- based on a scenario involving an industrial company manufacturing coffee makers and coffee machines over a period of six years.
- with practical exercises focusing on:
- Provisional financial statements, dashboards, financial analysis, cost calculation, return on investment, and business strategy.
- Management projects initiated by engineering students in companies

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
apply the concepts covered in the management module in a practical way	Mastery	use management concepts in the context of business projects

develop financial reflexes for managing the company in response to unforeseen events, opportunities, and market conditions	Mastery	making decisions during projects based on available financial information

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12

Mandatory prerequisites

- Have completed the previous course
- Have completed a management project in your company

Course outline

Formation of company groups

Simulation of company life

Review and feedback

Additional information

Bibliography

Business Strategy - Concepts, Models, Tools, Examples (2nd edition)

Dominique Jolly (Author)

Skills acquired

Macro-skill	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Sustainable Development - Product Approach (SHES711_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This course is divided into several parts:

- an introduction to environmental issues in business,
- a focus on the eco-design approach (definition, tools, and methods),
- the methodology for analyzing the life cycle of products or services,
- an overview of regulatory constraints
- insight into how companies can benefit from the approach.

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
understand the approach of eco-design and understand the	Application	to take into account the challenges environmental issues and regulations

key challenges of its application in business		when designing a product or service

Teaching hours

Lectures	Lecture	4
Tutorial	Tutorials	2
Lab	Practical work	8

Mandatory prerequisites

Basic environmental concepts

Product design concepts

Course outline

The course is followed by two practical sessions:

- one session on learning how to assess the environmental impacts of a product
- one session on implementing an eco-design approach in a company

Additional information

Bibliography

Life Cycle Assessment: Understanding and Performing an

Ecobalance, 4th revised and expanded edition

Myriam Saadé - Oliver Jolliet

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Timoteo Payre
Timoteo.Payre@univ-savoie.fr

Locations

- Annecy-le-Vieux (74)

Campus

- Annecy / Annecy-le-Vieux campus

English (TOEIC level achieved) (LANG711_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** English **Teaching methods:** In person **Teaching format:** Tutorials
- **Open to exchange students:** Yes **ERASMUS**
- **reference:** Languages

Presentation

Description

English at work

Continuous speaking, discussion based on business topics, project presentations, acquisition of business vocabulary and linguistic enrichment, grammar and phonetic correction.

Objectives

Becoming as independent as possible in an English-speaking industrial environment

Teaching hours

Tutorials	Tutorials	34

Mandatory prerequisites

TOEIC score of 785 or higher, except for continuing education students, who must have obtained a score of 600 or higher.

Course outline

Various presentations by specialists in industrial and business-related fields, mainly English speakers

Additional

Bibliography

Various documents provided by speakers and/or students themselves.

Skills

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

English (TOEIC level not achieved) (LANG710_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** English, French
- **Teaching methods:** In person **Teaching**
- **format:** Tutorials **Open to exchange students:**
- Yes **ERASMUS reference:** Languages
-

Presentation

Description

This course prepares students for the TOEIC (Test of English for International Communication) exam, specifically to obtain a minimum score of 785 points (out of 990).

With the aim of developing all four skills, this course also serves as an introduction to public speaking through presentations given by students in groups or individually on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate, as well as written work). Depending on the location (Annecy or Chambéry), some will be seen at different times during the semester, the year, or even the three years of training.

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam.

Objectives

Specific objectives: at the end of this course, students will be able to:

work on telephone conversations (comprehension/production)

listen regularly to news on English-language news sites (CNN, BBC, Sky News, etc.) and be able to succinctly summarize the main points orally, interacting with the class

work on a variety of audio and video materials and speak spontaneously in an interactive manner with the class

to speak in a prepared manner and interact spontaneously through individual presentations (self-presentations and/or article reviews, such as "quizzes") and presentations in pairs (various topics)

practice TOEIC exercises (4 parts of listening comprehension) + entire tests

Teaching hours

Tutorials	Tutorials	34

Mandatory prerequisites

S5 and S6 program.

Course outline

Course outline

1. **Review of important grammar points for the TOEIC:**
   1. Review of tenses.
   2. The conditional and "should" structures (suggestion/subjunctive)**.**
   3. Modal auxiliaries and periphrases with similar meanings.
   4. Linking words (revision).
2. **Listening comprehension:**
   1. Recorded dialogues in American, British, and New Zealand English.
   2. Videos in American, British, and Australian English.
3. **Reading comprehension:**
   1. Press excerpts
   2. Various texts

Additional information

Bibliography

- Documents distributed by speakers
- Various websites listed at the beginning of S5

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE702 Work experience

ECTS
10 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	CM	Tutorial	Practical	Credits
Project 2 (launch and follow-up)	MODULE hour	1		8	
Progress in the workplace (advancement)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 2 (launch and follow-up) (PROJ701_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French
- **Teaching methods:** In person
- **Teaching format:** Learning and assessment situation
- **Open to exchange students:** Yes

Presentation

Description

In this module, engineering students will be required to carry out a mainly technical project within the company, implementing a structured and effective approach.

The technical component is considered in a broad sense (products, production processes, organization, etc.).

This project may be continued in semester 8, during which engineering students will develop its economic component. If company constraints do not allow this, it will be possible to choose a new project.

Objectives

Situate your project within the company's overall strategy and understand its challenges:

- Assess the importance of your project in relation to other ongoing projects

- anticipate and take into account changes within the company to ensure the project's

sustainability Broaden the range of possible solutions:

- justify your choices

- systematically integrate relevant health, safety, and environmental aspects

Teaching hours

Lectures	Lecture	1
Lab	Practical work	8

Course outline

Launch

Support: framing of technical assignments/projects, implementation of project management/problem-solving tools/methods, taking a step back from the project—confidentiality, approach, choices, personal development, etc.

Interim oral presentation accompanied by a written report (project summary sheet)

Bibliography

None

Skills

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Career development (progression) (STAG701_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This assessment allows us to see the apprentice's progress throughout the various projects and tasks carried out within the company. The semester 7 assessment relates to the Extended Technical project.

Objectives

Be a good engineer and have good relationships with others:

- get involved

- be organized

- make decisions

- solve problems

- take responsibility

Mandatory prerequisites

None

Course outline

Drafting of the project orientation sheet.

Evaluation carried out by the company.

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy (74)

Campus

Annecy / Annecy-le-Vieux campus

UE703 Engineering Sciences

ECTS
12 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Random signals	MODULE	12 hours	12		12
Automatic - Stability and control of systems Functional materials for instrumentation	MODULE	10 hours	10.5 15		16
Data acquisition systems - Graphical programming	MODULE	21.5 hours			32
Embedded systems and concurrent programming	MODULE	4.5 9 a.m.	3		24

Practical information

Locations

Annecy-le-Vieux (74)

Functional materials for instrumentation (PACI741_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French
- **Open to exchange students:** Yes

Overview

Description

This course describes materials with specific properties used in sensors, actuators, and mechatronic devices: explanation of the physical phenomena involved in these materials, description of behavior models used to account for their properties, applications.

This course describes the specific properties of smart materials used in sensors, actuators, and mechatronic devices. Physical phenomena involved in these materials, description of behavior models, physical properties, and applications are explained.

Objectives

- Identify the classes of active materials used in various measurement and transduction applications.
- Explain the behavior of different classes of materials with respect to electrical, magnetic, and electromagnetic stresses.

Teaching hours

Lectures	Lecture	21.5
Tutorial	Tutorials	15

Mandatory prerequisites

- Fundamentals of general physics
- Electromagnetism.
- Mathematical tools: integrals, derivatives, coordinate systems, operators, vector analysis, matrix calculus

Course outline

1. Dielectric properties: polarization, dielectric strength and permittivity, pyroelectricity and ferroelectricity
2. Piezoelectric materials
3. Piezoresistive and electrostrictive materials
4. Magnetic properties of materials: magnetization, magnetic permeability, para-, dia-, and ferromagnetism
5. Magnetoresistive and magnetostrictive materials
6. Birefringence and electro-optic modulation

Bibliography

- David Jiles, Introduction to magnetism and magnetic materials, Ed Chapmann and Hall, 1994
- Yuhuan Xu, Ferroelectric Materials and their applications, Ed North-Holland, Elsevier, 1991

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Thomas Mazingue-Desailly +33 4 50 09 65 68
Thomas.Mazingue-Desailly@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Data Acquisition Systems - Graphical Programming (PACI742_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

Program digital data acquisition/generation systems using a graphical language (LabVIEW).

Objectives

Understand the different components of the analog or digital signal acquisition chain Implement the different

possibilities offered by an acquisition device associated with a computer

Design, based on the description of an instrumentation requirement, the software application that uses the acquisition/generation hardware implemented.

Teaching hours

Lectures	Lecture	4.5
Lab	Practical work	32

Mandatory prerequisites

Must have completed modules EASI501 and PACI741 or possess equivalent knowledge.

Course outline

1. Digital acquisition/generation systems: architectures, performance, and programming
2. Digital-to-analog and analog-to-digital converters *(review)*
    1. Digital-to-analog converters: structures, operating principles, and performance
    2. Analog-to-digital converters:
        1. Voltage-balanced: Structures, principles, and performance
        2. Charge-balancing: Structures, principles, and performance
        3. Sigma/Delta Converters

Additional information

N/A

Bibliography

- Francis COTTET, LabVIEW: Programming and Applications, DUNOD
- Francis COTTET, Signal Processing and Data Acquisition, DUNOD
- NI website: www.ni.com

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Michelle Passard

+33 4 50 09 66 01

Michelle.Passard@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Embedded Systems and Concurrent Programming (INFO741_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French, English
- **Teaching methods:** In person **Open to**
- **exchange students:** Yes

Presentation

Description

This module covers the operation of embedded systems running on an operating system. It also presents the constraints associated with real-time and multitasking issues. Finally, this course addresses the implementation of a real-time, multitasking embedded system based on specifications.

Objectives

Perform multitasking programming using MUTEX objects (locks, semaphores, conditional variables)

Implement a complex real-time, multitasking system on a Raspberry Pi running a Linux OS based on specifications

Teaching hours

Lectures	Lecture	9
Tutorial	Tutorials	3
Lab	Practical work	24

Mandatory prerequisites

INFO501: Numbering and Algorithms

INFO741: Embedded Systems - Operating Systems

Course outline

1. Embedded systems operation: programmable circuit architecture, development tools
2. Real-time processing: constraints, priority order (interrupt-driven operation), adapting multitasking programming to real time
3. Development of a real-time application on an embedded system: use of the Raspberry Pi platform (with embedded Linux), application development, testing and validation, communication with Arduino

Targeted skills

Specify, analyze, design, and implement computer systems, particularly embedded and communication systems (proficiency)

- by integrating interactions between the application and software and hardware architectures

- by adopting a systems approach

- by focusing on intelligent instrumentation and communicating objects

Bibliography

https://hpc-tutorials.llnl.gov/posix/

http://www.yolinux.com/TUTORIALS/LinuxTutorialPosixThreads.html

Skills acquired

Macro-skill	Micro-skills

Practical information

Contacts

Course Director Guillaume Ginolhac
+33 4 50 09 65 83
Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE801 SHES - Languages

ECTS
5 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Support (half of Thursday afternoons when FISA staff are present)	MODULE				

	Nature	CM	Tutorial	Practical	Credits
Management and technical communication	MODULE	6	4	12	

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved)	MODULE		40 hours		
English (TOEIC level achieved)	MODULE		40 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Management and Technical Communication (SHES801_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

The objective of this module is:

- to provide future engineers with the main tools for self-awareness, enabling them to communicate more effectively and take on their future responsibilities in a positive manner, whether functional or hierarchical;
- to support future engineers, through progressive methodological steps, in the management and presentation of their various projects.

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
define the main tools of self-awareness to enable them to communicate better and take positively assume their future whether functional or hierarchical	Mastery	to communicate effectively
		assume his future responsibility

lead and report on their various projects	Mastery	prepare reports and presentations of projects carried out in company

Teaching hours

Lectures	Lectures	6
Tutorial	Tutorials	4
Lab	Practical work	12

Mandatory prerequisites

- Herrmann's Brain Preferences Model
- The "organization" (time management, delegation) and "problem solving" approaches covered in Cognitive Development/Intro to Management (SHES591)

Preparation/presentation of the preparatory topic "Project Management and Extended Technical Project Specifications"

Course outline

1. Inventory of the main strategic, technological, and organizational changes at work in the company and in society, and their consequences on human resource management: historical and sociological retrospective
2. In-depth study of the concept of responsibility and accountability
3. Personal development:
   - basics of responsible and assertive communication
   - Transactional Analysis approach: self-diagnosis of "ego states," conditioning messages, life positions

Practical work titles

- Acquisition of project terminology (challenges, objectives, indicators, resources, constraints, PDCA, validation, sustainability)
- Development of a "context" grid and definition of the qualities and expectations of a project manager based on Herrmann
- End of "technical" project period, "management" project leadership: Monitoring and support work on projects; mutual field advice
- Methodological contributions: argumentation and demonstration
- Written/oral expression contributions

Additional information

Bibliography

The Secrets of Communication

John Grinder

The essentials of business management

Samuel Josien

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator
Delphine Lacquement
+33 4 79 75 85 85
Delphine.Lacquement@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

English (TOEIC level not achieved) (LANG810_PACYFISA)

Polytech Annecy-Chambéry

In brief

- **Languages of instruction:** English, French
- **Teaching methods:** In person **Teaching**
- **format:** Tutorials **Open to exchange students:**
- Yes **ERASMUS reference:** Languages

Presentation

Description

This course prepares students for the TOEIC test ("Test of English for International Communication") and, more specifically, for obtaining a minimum score of 785 points (out of 990).

The TOEIC test will take place at the end of this semester at each of the sites on very similar dates. (Make-up sessions will take place in week 9).

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam, depending on the semester.

Objectives

Specific objectives: At the end of this course, students will be able to:

continue practicing TOEIC exercises (4 parts of listening comprehension) + entire tests

work on a variety of audio and video materials (general English, business English, and specialized English) and speak spontaneously, interacting with the class

speak in a prepared manner and interact spontaneously through scientific presentations and on topics or issues related to the business world (job interviews, negotiations, discussions on technical/professional projects, wage inequality, international mobility, etc.)

Specific objectives: at the end of this course, students will be able to:

continue grammatical revision on: the conditional tense; all other tenses; expressing suggestions and modality/the passive voice; verbal structures (infinitive/ing)

improve their grammatical and lexical knowledge (general English, business English, and English specific to their scientific field), both in class and independently, validating their progress through regular tests

Teaching hours

Tutorials	Tutorials	40

Mandatory prerequisites

LANG710

Course outline

Course outline

1. **Review of important grammar points for the TOEIC**
    1. Review of all tenses covered or reviewed in S5, S6, and S7.
    2. The passive voice.
    3. Causative structures.
    4. BV / BVing or to BV.
    5. Linking words.
2. **Listening comprehension**
    1. Recorded dialogues in American, British, and New Zealand English.
    2. Videos in American, British, Australian English, etc.
3. **Reading comprehension**
    1. Press excerpts
    2. Various texts

Additional information

Bibliography

Documents provided by Global Exam speakers

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

English (TOEIC level achieved) (LANG811_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** English **Teaching methods:** In person **Teaching format:** Tutorials
- **Open to exchange students:** Yes **ERASMUS**
- **reference:** Languages

Presentation

Description

English at work

Continuous speaking, discussion based on business topics, project presentations, acquisition of business vocabulary and linguistic enrichment, grammar and phonetic correction.

Objectives

To be and become as autonomous as possible in an industrial context in English

Teaching hours

Tutorial	Tutorials	40

Mandatory prerequisites

TOEIC score of 785 or higher, except for continuing education students, who must have obtained a score of 600 or higher

Course outline

Various presentations by specialists in industrial and business-related fields, mainly English speakers

Additional

Bibliography

Various documents provided by speakers and/or students themselves.

Skills

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE802 Work experience

ECTS
7 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 2 (Monitoring and reporting)	MODULE			8 hours	
Corporate development (4 areas)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 2 (Monitoring and reporting) (PROJ801_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French
- **Open to exchange students:** Yes

Overview

Description

In this module, engineering students will be required to carry out an economics-oriented project within their company (either a continuation of the project from semester 7 or a new project).

The aim of this project is for engineering students to realize the importance of economic factors in the smooth running of any industrial project and their impact on the company.

Objectives

Measure the importance of economic factors in the management of any project (decision to launch, investment strategies and decisions, management and performance indicators) and for the effective management of all or part of the company (a department, a workshop, a production line, etc.):

- Use management knowledge in the management of a business project Master the

main economic and financial parameters of the business:

- take economic and financial data into account when working on an industrial project

Make the numbers "speak," know how to translate them clearly for their appropriation and use at operational levels of the company:

- present and use economic and management data for an industrial project

Teaching hours

Practical work	Practical work	8
Other	Other	1

Course outline

Support: framing of economic missions/projects, implementation of project management/problem-solving tools/methods, identification and testing of economic tools/concepts useful to the project

Report & Defense of the P2 project - presentations covering the two components of Technical and Management/Economics and meeting the associated expectations -

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Corporate Development (4 areas) (STAG801_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This monitoring allows us to see the apprentice's progress throughout the various projects and tasks carried out within the company. The semester 8 assessment relates to the Management project.

Objectives

Be a good engineer and have good relationships with others:

- get involved

- be organized

- make decisions

- solve problems

- take responsibility

Mandatory prerequisites

None

Course outline

Writing a project orientation sheet. Assessment carried

out by the company.

Additional

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE803 Engineering Sciences

ECTS
18 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Decentralized automation	MODULE			24	
Image analysis and computer vision	MODULE	15 hours	13.5 hours	12	
Experimental physics, measurements, sensors, and instrumentation	MODULE	4	13.5	32	
Networks and security for embedded systems	MODULE	p.m		hou	
Discrete event system models and applications	MODULE	. 9	19.5	rs	
		p.m		36	
		.		hou	
		9		rs	
				12 p.m.	

Practical information

Locations

Annecy-le-Vieux (74)

Experimental physics, measurements, sensors, and instrumentation (PACI841_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

The objective of this course is to learn how to choose a sensor for a given application. To this end, the module covers the basics of metrology, describes the operating principles of the main types of sensors and the associated conditioning electronics, as well as the physical phenomena involved. The module consists of lectures, tutorials, practicals, and projects that allow students to deepen and apply the knowledge covered in these areas during the course.

Objectives

Identify the classes of active materials used in different applications Understand different

physical principles of transduction

Evaluate the performance of the measuring device, including the sensor

Design a sensor and its packaging according to a given set of specifications Present the work

carried out in a rigorous manner

Teaching hours

Lectures	Lecture	16
Tutorial	Tutorials	13.5
Lab	Practical Work	32
PROJ	Project	4
PTUT	Supervised project	12

Mandatory prerequisites

Have completed the modules and assimilated the knowledge of EASI501, PHYS541, PHYS542, PACI641, PACI642, and PACI741.

Course outline

1. **Metrology and Sensors**
   1. Definitions
   2. Measurable quantities
   3. Metrological characteristics
2. **Physical principles of sensors**
   1. Optical transducers
   2. Thermal transducers
   3. Magnetic transducers
   4. Mechanical transducers
3. **Sensor conditioning electronics**
   1. Passive sensors
   2. Wheatstone bridge
   3. Impedance bridges
   4. Active sensors
   5. Acquisition chain structures
   6. Common mode rejection
4. **Sensor study**
   1. Sensors for mechanical quantities: acceleration, velocity, force, position, and displacement
   2. Fluid sensors: pressure, velocity, flow rate
   3. Sensors for thermal quantities
   4. Optical sensors
   5. Micro-sensors

Additional information

N/A

Bibliography

- Georges ASCH, Sensors in Industrial Instrumentation, DUNOD
- Experimental physics: optics, fluid mechanics, waves, and thermodynamics: experiments M. Fruchart, P. Lidon, E. Thibierge, M. Champion, A. Le Diffon De Boeck supérieur, 2016
- R. PALLAS-ARENY and J.G. WEBSTER, Sensors and Signal Conditioning, Wiley Interscience
- P.P.L. REGTIEN, Measurement Science for Engineers, Kogan Page Science

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator

Michelle Passard

+33 4 50 09 66 01

Michelle.Passard@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Networks and security for embedded systems (INFO843_SNIFISA_ACY)

Polytech Annecy-Chambéry component

Presentation

Description

This course will present computer and field networks with related security elements. The network section will be built step by step, starting with the hardware layer and working up the network stack to arrive at the most common abstractions in computer science. The security section will present the most common attacks on networks and how to protect against and detect them.

Objectives

- Understand how the different network layers work (transmission and modulation, sockets, TCP/IP/Ethernet, etc.)
- Learn about the most common attack methods and how to detect and protect yourself against them.

Teaching hours

Lectures	Lecture	9 p.m.
Lab	Practical work	36

Mandatory prerequisites

INFO501

Course outline

1. Physical layer and data link (Layers 1 and 2)
2. Network layer (layer 3, IP and addressing)

3. Transport layer (layer 4, TCP/UDP, sockets)
4. Application layer (HTTP, other protocols)
5. Network security (common attacks and prevention)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)

Discrete Event Systems Models and Applications (EASI844_SNIFISA_ACY)

Polytech Annecy-Chambéry
component

In brief

- **Languages of instruction:** French **Teaching**
- **methods:** In person **Open to exchange**
- **students:** Yes

Presentation

Description

The objective of this course is to introduce the concepts of discrete event systems, their various models, and the benefits of these models (communication, sizing, verification, simulation, prediction, supervision, etc.). We will focus not only on various mathematical models of such a system, but also on modeling its inputs in order to predict the future states and outputs of the system based on its current state and available inputs. Analytical and learning-based approaches will also be discussed.

Objectives

Choose an appropriate type of SED model from a given system and for a given question relating to expected operation.

Determine, for a given system model and a given question relating to its expected operation, whether or not a target property is satisfied.

Teaching hours

Lectures		Lecture	9
Tutorial		Tutorials	7:30 p.m.
Lab		Practical work	12

Mandatory prerequisites

Basic concepts of in Algebra (matrices and graphs), Analysis functional de data, variables and random vectors random, Automation, Object-oriented design and programming, Software development.

Course outline

1. Discrete Event Systems, Modeling, Petri Nets
2. Timed Event Graphs, Max-Plus Algebra, Verification, Validation, and Supervision
3. Counting and Markovian processes
4. High-level models - Domain exploration - Autonomous learning and bibliographic research

Bibliography

Cassandras, C.G. and Lafortune, S., Introduction to Discrete Event Systems, Springer, 2008, 772 p. (ISBN 978-0-387-33332-8 and 0-387-33332-0, read online [archive])

Annie Choquet-Geniet, Les réseaux de Petri : Un outil de modélisation (Petri Networks: A Modeling Tool), Paris, Éditions Dunod, coll. "Sciences Sup," March 7, 2006, 240 p. (ISBN 2-10-049147-4)

Planning with deadlines in stochastic domains | Proceedings of the eleventh national conference on Artificial intelligence [archive], on dl.acm.org (accessed March 19, 2020)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Abdourrahmane Atto
+33 4 50 09 65 27
Abdourrahmane.Atto@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE901 SHES - Languages

ECTS
7 credits

Polytech Annecy-Chambéry

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Legislation, labor law, occupational health, sustainable engineering, decarbonization	MODULE	18 hours	8	8	
GEPC, humanities, management, ergonomics	MODULE	28			

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved)	MODULE		26 hours		
English (TOEIC level achieved)	MODULE		26 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Legislation, labor law, occupational health, sustainable engineering, decarbonization (SHES901_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

Legislation and labor law

Occupational health

Sustainable engineering and decarbonization

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
define the scope of human resources and labor legislation	Application	use their knowledge of human resources and labor legislation in their company
analyze and deal with a situation	Application	apply legal concepts to a situation in the workplace

Know the main concepts of ergonomics	Application	apply ergonomic concepts in an industrial context
take ergonomic considerations into account in their areas of activity and responsibility	Application	apply knowledge of ergonomics to projects within the company

Teaching hours

Lectures	Lecture	18
Tutorial	Tutorials	8
Lab	Practical Work	8

Mandatory prerequisites

Legal concepts covered in semester 5

Sustainable development modules from semesters 5, 6, and 7

Course outline

1. Legislation
   - Sources of labor law and judicial organization
   - Key elements of the employment contract
   - Working hours/salaries/paid leave
   - Employee representation
   - Elements of civil and criminal liability of managers and their employees
2. Ergonomics
   - Ergonomics (origin, definition, scope)
   - Workstation design
   - Physical fatigue
   - Mental fatigue
   - Thermal comfort
   - Visual comfort
   - Auditory comfort
   - Workstation analysis method and ergonomic approach
   - Contribution of ergonomics to the prevention of hardship
3. Sustainable engineering

Additional information

Bibliography

Ergonomics at work, principles and practices

Pascal Reytier

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator
Véronique Saudrais

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

GEPC, Humanities, Management, Ergonomics (SHES902_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

Project management and

leadership Skills management

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
acquire an understanding of the collective dimension of day-to-day activity management and change management	Master	define skills management
		understand the challenges of job and skills management
		understand the philosophy of GPEC (forward-looking management of jobs and skills) and its direct link to company strategy

		understand common HR vocabulary: skills, qualifications, performance, jobs, etc.
		Identify and understand the role of the engineer in the GPEC process
identify and understand the use of the main job and skills management tools (job map, job descriptions, skills frameworks, appraisal interviews, etc.)	Master	understand the principles behind the creation of these tools
		create a simple job description
		recruit
		understand the recruitment process and its main stages
		identify pitfalls to avoid
understand the contingency of the recruitment process (depending on the profile, time available, budget, etc.)	Master	understand the legal framework for recruitment (basic concepts)
		understand the main stages of the recruitment interview
		understand judgment biases and be able to avoid them
		understand the basic principles of assessment tools (tests)

Teaching hours

Lectures	Lecture	28

Mandatory prerequisites

- The entire second-year module: personal development
- Definition of the "team management/leadership" project
- Knowledge of the company

Course outline

1. Project management and leadership
   - Leading a team: taking on the role of leader or manager; status, roles, performance indicators, and team monitoring; adaptive management

- The group: its personality, its evolution, the role of the leader, group phenomena (application to meeting facilitation)
- Leading a "sensitive" project: lateralizing it, identifying and developing the roles of the various players, adapting to each type
- Leading change: crisis or change, individual and collective emotional cost, qualities of the leader, successive stages and support
- Managing conflict: preventive, curative, interindividual, and collective approaches, from conflict to negotiation: prerequisites for negotiation, range of tactics and strategies used

2. Skills management

- Theoretical aspects

2.1.1.The history of skills management (career management, job management, etc.) 2.1.2.The

conventional and legal aspects of GPEC

2.1.3. Key definitions (distinction between job and position, competency and performance, etc.)

- The link between job and compensation (collective bargaining agreement, classification/rating, etc.)
- GPEC tools
- Creating a job map

2.2.2.Methodology for creating a job description

2.2.3.Skills frameworks

- Skills assessment
- GPEC as a strategic approach
- Developing a comprehensive action plan

2.3.2.Different ways of implementing GPEC

2.3.3.GPEC stakeholders

1. Recruitment

- The recruitment process

3.1.1. Recruitment: a strategic business tool

3.1.2. The stages of recruitment

- The cost of recruitment
- The recruitment interview
- Interview conditions

3.2.2.Interview support

3.2.3.Conducting a recruitment interview

- Judgment biases to avoid
- Tests
- Types of tests

3.3.2.Methods for the statistical construction of a test

3.3.3.Test validity

Practical work titles

- Simulations of difficult communication situations: listening, criticism, conflicts
- Formation of "project management" working groups
- Management insights in response to various "management/team leadership" projects
- Preparation for the presentation of projects within the company

Additional information

Bibliography

- CADIN Loïc, GUERIN Francis, and PIGEYRE Frédérique (Eds.). – Human resource management: practice and theory. – 2nd ed. – Paris: Dunod, 2004
- DEFELIX Christian, DUBOIS Michel and RETOUR Didier. - GPEC: forward planning in crisis? – In: HRM in the face of crisis: HRM in crisis? – edited by Tremblay M. and Sire B. – Montreal: Presses des l'école des HEC, 1997
- DENIMAL Philippe. – Classification, qualification, skills: for action on organization and social dialogue. – 1st ed. – Paris: Editions Liaisons, 2004
- FLÜCK Claude. – Skills and Performance: a successful alliance. – 1st ed. – Paris: DEMOS, 2001
- LUSSATO Ariane – Recruitment tests – Que Sais-Je – Presses Universitaire de FranceMINTZBERG Henry. – Structure and dynamics of organizations. – 12th ed. – Paris: Editions d'Organisation, 1982
- PERETTI Jean-Marc (Ed.). – Tous DRH. – 2nd ed. – Paris: Editions d'Organisation, 2006
- PERMATIN Daniel. – Managing by skills or how to succeed differently? – 1st ed. – Caen: Editions Management Société, 1999

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Delphine Lacquement

+33 4 79 75 85 85

Delphine.Lacquement@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

English (TOEIC level not achieved) (LANG910_PACYFISA)

Polytech Annecy-Chambéry

In brief

- **Languages of instruction:** English, French
- **Teaching methods:** In person **Teaching**
- **format:** Tutorials **Open to exchange students:**
- Yes

Presentation

Description

This course prepares students (who have not yet validated their score) for the TOEIC ("Test of English for International Communication") exam, and more specifically for obtaining a minimum score of 785 points (out of 990).

Objectives

To develop certain reflexes and autonomy in taking the TOEIC or Linguaskill test at the end of S8 in order to achieve the score required for validation of the engineering degree.

Teaching hours

Tutorials	Tutorials	26

Mandatory prerequisites

LANG 810

Course outline

1. **Review of important grammar points for the TOEIC**
    1. Review of all tenses covered or reviewed in S5, S6, S7, and S8
    2. The passive voice.
    3. causative structures.
    4. BV / BVing or to BV.
    5. Linking words.
2. **Listening comprehension**
    1. Recorded dialogues in American, British, and New Zealand English.
    2. Videos in American, British, Australian English, etc.
3. **Reading comprehension**
    1. Press excerpts
    2. Various texts

Additional information

Bibliography

Various documents distributed by speakers Global Exam

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Muriel Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

- Annecy-le-Vieux (74)

Campus

- Annecy / Annecy-le-Vieux campus

English (TOEIC level achieved) (LANG911_PACYFISA)

Polytech Annecy-Chambéry

In brief

- **Languages of instruction:** English **Teaching methods:** In person **Teaching format:** Tutorials
- **Open to exchange students:** Yes **ERASMUS**
- **reference:** Languages

Presentation

Description

This course prepares students for their entry into professional life. Leading or participating in a meeting: vocabulary and structures related to this aspect while continuing to work on the four skills, but with an emphasis on realistic situations (role-playing, acquisition of technical vocabulary and business vocabulary, etc.). But also public speaking through presentations given by students in groups and/or individually. Students are assessed throughout the semester. Preparation of the engineering theme (English section compulsory) Simulation of an interview in front of two members of the jury and half the class.

Objectives

To become as independent as possible in their future profession

Teaching hours

Tutorials	Tutorials	26

Mandatory prerequisites

LANG811 and Toeic validated

Course outline

Labels (country culture for international exchange) Preparation of CVs

and self-presentations and business projects

Additional information

Bibliography

Various documents provided by lecturers and students themselves

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Muriel
Yvenat
+33 4 50 09 66 17
Muriel.Yvenat@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE902 Work experience

ECTS
10 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 3 (Launch and follow-up)	MODULE	1 hour			8
Progress in the workplace (advancement)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 3 (Launch and follow-up) (PROJ901_PACYFISA)

Polytech Annecy-Chambéry
Component

In brief

- **Languages of instruction:** French
- **Teaching methods:** In person
- **Teaching format:** Learning and assessment situations
- **Open to exchange students:** Yes

Presentation

Description

In this module, engineering students will be required to carry out a management-oriented project within a company, implementing a structured and effective approach.

The managerial component is considered in a broad sense (hierarchical or cross-functional management, communication, team leadership, training, change management, conflict management, etc.).

The aim of this project is for engineering students to understand the importance and impact of the human factor on the smooth running of any industrial project.

This project may be continued in semester 10 and become the Engineering Project, expanding it to meet the end-of-program expectations.

Objectives

Develop an effective human approach to project management:

- anticipate the humanly sensitive stages of the project

- define the principles adopted for project management

- identify the obstacles encountered and the actions taken in response

- Monitor and define validation steps with a view to sustainability

Use human resources tools that are appropriate for the company, whether they are already in use or whether this project provides an opportunity to propose new ones (skills, training, procedures, facilitation, etc.):

- Implement human resources tools in projects carried out within the company

- if necessary, select new dedicated tools

Teaching hours

Lectures	Lecture	1
TP	Practical work	8

Mandatory prerequisites

Projects from semesters 5, 6, 7, and 8.

Modules from semesters 5, 6, 7, and 8: SHES511_PACYFISA, SHES801_PACFISA, and SHES902_PACFYSA

Course outline

Launch

Support: framing of human-centered projects, implementation of project management/problem-solving tools/methods, identification and testing of human resources tools/approaches useful to the project, critical analysis and areas for improvement

Interim defense in the company, with an active visit organized and led by the engineering student.

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Career development (progression) (STAG901_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This monitoring allows us to see the apprentice's progress during the various projects and work carried out in the company.

The semester 9 assessment relates to the Management project.

Objectives

Be a good engineer and have good relationships with others:

- get involved

- be organized

- make decisions

- solve problems

- take responsibility

Mandatory prerequisites

None

Course outline

Writing of the project guidance sheet.

Evaluation carried out by the company.

Additional information

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy (74)

Campus

Annecy / Annecy-le-Vieux campus

UE903 Engineering Sciences

ECTS
13 credits

Polytech Annecy-Chambéry

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Internet of Things	MODULE	3	9	24	
Automatic state approach: representation, control, and observation	MODULE	25.5	25.5	20	
3D imaging: acquisition, reconstruction, applications	MODULE	10.5 hours	10.5 hours	12	
Advanced Machine Learning	MODULE	12 hours		24	

Practical information

Locations

Annecy-le-Vieux (74)

Automatic state approach: representation, control, and observation (EASI943_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

At the end of this module, students will be able to represent continuous or sampled multivariable linear systems in the form of a state representation. They will also be able to analyze the properties of such systems (stability, controllability, observability) and control them using state feedback control. State observation, observer synthesis (LUENBERGER), and the implementation of state feedback control with observers are also covered.

Objectives

Master the state representation of continuous and sampled multivariable linear systems and the analysis of such systems (stability, controllability, observability).

Understand the principle of feedback control and know how to calculate such controls.

Be able to synthesize a state observer and use it in the implementation of a feedback control system.

Teaching hours

Lectures	Lecture	25.5
Tutorial	Tutorials	25.5
Lab	Practical work	20

Mandatory prerequisites

EASI641 (Signals and Systems)

EASI744 (Automatic Control: Stability and Control of Systems)

Course outline

Part 1: Representation, Control

1. Introduction

2. State Representation

2.1. State Model

2.2. Evolution equation

2.3. Block Associations

2.4. Transition from the state approach to the transfer approach (transfer function or matrix)

2.5. State representation of discrete-time systems

3. Analysis of a state model

3.1. Stability

3.2. Static gain

3.3. Controllability

3.4. Observability

3.5. Example

3.6. Concept of minimal realization

3.7. Zeros of a system in state representation

4. State feedback control

4.1. Principle

4.2. Application to a single-variable system

4.3. Decoupling and stabilizing control (multivariable systems).

Part 2: State observation

1. Assumptions and objectives

2. Luenberger observer

2.1. Continuous time

2.2. Discrete time

2.3. Luenberger observer and additive disturbance

3. Extended Observers

3.1. Constant disturbance

3.2. Ramp disturbance

4. State feedback control with observer

4.1. State feedback control

4.2. The principle of separation

Bibliography

"Automatique - Systèmes linéaires, non linéaires, à temps continu, à temps discret, représentation d'état" (Automation - Linear, nonlinear, continuous-time, discrete-time systems, state representation), Yves GRANJON, 4th edition, 2021, DUNOD.

"Automation - Control and Diagnosis of Dynamic Systems - Modeling, Analysis, PID and State Feedback Control, Diagnosis," Rosario TOSCANO, 2011, TECHNOSUP.

"Control of Linear Systems," Philippe DE LARMINAT, 2002, LAVOISIER.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal Mouille
+33 4 50 09 65 81
Pascal.Mouille@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

3D imaging: acquisition, reconstruction, applications (EASI942_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French, English
- **Teaching methods:** In person **Open to**
- **exchange students:** Yes

Overview

Description

Introduction to 3D image acquisition, reconstruction, and processing

This course mainly addresses: acquisition, reconstruction, segmentation, and analysis of 3D images acquired by means of X-ray tomography. Examples are given in the field of industrial control (non-destructive testing, materials science, etc.) as well as medical imaging.
Case studies are presented by industrialists and research engineers from the company RX-solutions or at the European Synchrotron Radiation Facility (ESRF).

A visit to the facilities of the company RX-solutions (an SME manufacturing tomographs) is organized in parallel with the course. The

course is composed of three parts:
* physical aspects; interaction of radiation with matter
* computed tomography
* 3D image processing

Case studies are presented by industrialists and research engineers from the company RX-solution and at the ESRF. A visit to the RX-solutions facilities is organized in parallel with the course.

Course documents are in English. Lectures are given in English for non-French speaking students.

Objectives

- learn about the main techniques for surface analysis and material inspection by reflection (optical) or transmission (acoustic, electromagnetic, electronic)
- To learn about the associated sensors
- solve an inverse problem in the case of 2D and 3D reconstruction
- choose processing and analysis operators from a library
- draw up specifications and prepare a response to a call for tenders

Teaching hours

Lectures	Lecture	10.5
Tutorial	Tutorials	10.5
Lab	Practical work	12

Required prerequisites

MATH641, MATH642, EASI642, EASI842 or equivalent knowledge. Basic knowledge in material science.

Course outline

1. Which imaging technique for a given application:
- ultrasound, terahertz, X-rays, neutrons, MRI, optical techniques, SPECT, PET

2. Computed tomography:
- modeling;
- analytical techniques (Radon transform, Fourier slice theorem)
- algebraic techniques
- practical issues (spatial resolution)

3. 3D image processing:
- visualization, filtering, shape analysis

Practical work:

Qualitative and quantitative study of a tomography device
- Characterization of the effect of acquisition and reconstruction parameters on image quality
- Characterization of the effects of poor mechanical adjustment

Bibliography

P. Grangeat, Tomography, ISTE/Wiley, 2009

P. Grangeat, Tomography: Mathematical Foundations, Microscopic Imaging, and Industrial Imaging, IC2. Hermes Publishing; 2002

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Lucia Di-Ciaccio-Burkhardt +33 4 79 75 85 85
Lucia.Burkhardt@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Advanced Machine Learning (DATA942_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This module dedicated to machine/automatic/deep learning aims to build complex models that are not necessarily analytical from a set of simple mathematical operators/concepts and learning data. The goal is to use the data and, depending on the problem to be solved (decision-making, decision support, segmentation, classification, content search based on a query, etc.), discover optimal functions capable of breaking down the data to extract meaningful attributes and thus lead to sophisticated processing of digital information. These functions can be very parsimonious (shallow learning) or organized into several highly complex layers (deep learning). Built on several scientific disciplines (statistics, numerical analysis, optimization, computer science, etc.) and a fundamental component of artificial intelligence, machine learning is now used in many fields of activity.

Objectives

Choose an artificial intelligence method appropriate for solving a data analysis or data search problem, then justify your choice, and finally interpret and evaluate the results obtained.

Teaching hours

Lectures	Lecture	12
Lab	Practical work	24

Mandatory prerequisites

Mastery of basic concepts in statistics, numerical analysis, optimization, computer science, digital systems, and mathematical modeling

Course outline

1. General issues
   1. Data (sets, big data, heterogeneous data, etc.)
   2. Typology of ensemble problems on such data
   3. Formulation of a deep learning problem on a dataset
2. Unsupervised learning (data sets)
   1. Direct data modeling
   2. Modeling of deep attributes extracted from the data
   3. Metrics and similarity measures on categorical attributes
3. Supervised learning (datasets)
   1. Data benchmarking
   2. Non-recurrent networks (mainly CNN)
   3. Recurrent networks (LSTM and variants)
4. Openness to other approaches on data sets
   1. Reinforcement learning
   2. Overfitting and open problems
   3. Adversarial generative models

Bibliography

A.M. Atto, Deep Convolutional Neural HyperSpaces and Deep Functional Analysis, ISTE Group, https://www.istegroup.com/en/product/deep-convolutional-neural-hyperspaces-and-deep-functional-analysis/

A. M. Atto, Convolutional Fractional Stochastic Fields and their Deep Learning, ISTE Group, https://www.istegroup.com/fr/produit/convolutional-fractional-stochastic-fields-and-their-deep-learning/

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Abdourrahmane Atto
+33 4 50 09 65 27
Abdourrahmane.Atto@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

UE001 Work experience

ECTS
22 credits

Polytech Annecy-Chambéry component

List of courses

	Type	Lectures	Tutorial	Practical	Credits
Project 3 (Monitoring and reporting)	MODULE			12 hours	
Career development (4 areas)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 3 (Monitoring and reporting) (PROJ001_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French
- **Teaching methods:** In person
- **Teaching format:** Learning and assessment situations
- **Open to exchange students:** Yes

Presentation

Description

In this module, engineering students will be required to carry out an engineering project within a company, involving technical, economic, and human aspects.

Objectives

Methodically manage an industrial project in a balanced and effective manner according to its three complementary components—technical, economic, and human—by:

- define and use project management tools for the technical, economic, and human aspects. Anticipate and

promote the smooth running of the project:

- analyze and predict potential risks in order to anticipate how to control them

- Define and monitor the action plan (associated countermeasures).

Use or implement relevant indicators and ensure the project's sustainability:

- define and use project management indicators covering technical, economic, and human aspects (monitoring and performance indicators)

- Identify the means and resources

- ensure the sustainability of results

- draw lessons that can be extrapolated for the future.

Teaching hours

Practical work	Practical work	12
Other	Other	2

Mandatory prerequisites

Projects and modules from semesters 5, 6, 7, 8, and 9 related to SHEJS and PROJ.

Course outline

Launch

Support: project scoping, advanced implementation of project management/problem-solving tools/methods, identification and management of the three essential components of an engineering project (technical, economic, and human), optimization of the approach and sustainability, taking a step back to consider the skills of an engineer, etc.

Thesis & Defense of the P3 project, including a section in English

Additional information

Bibliography

None

Skills acquired

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Corporate Development (4 areas) (STAG001_PACYFISA)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This monitoring allows us to see the apprentice's progress throughout the various projects and tasks carried out within the company. The semester 10 assessment relates to the Engineering project.

Objectives

Be a good engineer and have good relationships with others:

- get involved

- be organized

- make decisions

- solve problems

- take responsibility

Mandatory prerequisites

None

Course outline

Writing the project orientation sheet.

Assessment carried out by the company.

Additional

Bibliography

None

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Sandrine Vieules-Rosset
+33 4 50 09 65 05
Sandrine.Vieules-Rosset@univ-savoie.fr

Locations

Annecy (74)

Campus

Annecy / Annecy-le-Vieux campus

UE002 Engineering Sciences

ECTS
8 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Interdisciplinary project: facial recognition	MODULE			36	
Interdisciplinary project: embedded systems and robotics	MODULE			hou	
Communication systems, communication sensors	MODULE			rs	
				24	
				hou	
				rs	
				36	

Practical information

Locations

Annecy-le-Vieux (74)

Interdisciplinary project: facial recognition (PROJ002_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching**
- **methods:** In person **Teaching format:** Practical
- work **Open to exchange students:** Yes

Presentation

Description

The objective of this module is to develop an information processing application (images) on an embedded system.

This project will therefore combine several skills: those acquired in information processing (particularly image processing and AI), those acquired in programming, and those acquired in embedded systems. The projects will be carried out in groups (typically 5 students). They will comprise four aspects:

- the creation of an image processing program that performs facial recognition based on a machine learning algorithm

- implementing the program on an embedded system

- working in "project management" mode using methods (V, agile, etc.) and tools (planning, collaborative spaces, version management)

Objectives

The objective of this module is to apply image processing and machine learning algorithms for face recognition and then implement them on an embedded system.

Teaching hours

Practical work	Practical work	36

Mandatory prerequisites

- EASI842 - Image Analysis and Computer Vision
- INfO501 - Numbering and Algorithms
- INFO743 - Networks and Distributed Systems
- Embedded Systems I and II
- Machine Learning

Course outline

This project module consists of sessions scheduled in the timetable (24 hours) and supervised by project tutors, as well as independent work. The module is organized as follows:

- 3 four-hour sessions presenting the necessary knowledge
- 3.5 sessions of team work
- 1/2 session for assessment (report, oral presentation and team demonstration, and individual interviews to assess the skills acquired)

Additional information

Module combining data processing and embedded systems, allowing students to use a number of skills acquired during the 3 years of training

Bibliography

Machine learning algorithms: https://scikit-learn.org/stable/

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Guillaume Ginolhac
+33 4 50 09 65 83
Guillaume.Ginolhac@univ-savoie.fr

Locations

- Annecy-le-Vieux (74)

Campus

- Annecy / Annecy-le-Vieux campus

Interdisciplinary project: embedded systems and robotics (PROJ003_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Type of teaching:** Practical work
- **Open to exchange students:** Yes

Presentation

Description

This module aims to encourage students to reflect on and review their studies through a project involving robotics applications. This will enable them to apply various technical and interpersonal skills to complete a short project on a new material target.

Objectives

- Encourage students to reflect on and review the various concepts covered during the course
- Be able to supervise a small-scale project
- Demonstrate a sound use of the various tools covered in previous courses

Teaching hours

Practical work	Practical work	24

Mandatory prerequisites

NC

Course outline

Robotics project:

1. introduction to embedded systems used in robotics and their specific features
2. Implementation of processing procedures based on Turtle Bot 3.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)

Communicating systems, communicating sensors (EASI041_SNIFISA_ACY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching**
- **methods:** In person **Teaching format:** Practical
- work **Open to exchange students:** Yes
-

Presentation

Description

This module, carried out as a mini-project in teams, aims to design and build a small network of communicating sensors. The teaching approach, which is heavily based on self-learning, allows students to acquire the prerequisites necessary for this project while developing their independence. Additional resources (introduction to the communication protocol to be implemented, training in computer-aided electronic design, etc.) are provided during the project.In particular, each team must design and build an electronic circuit from scratch, including a sensor, a radio communication module, and additional components, using computer-aided design tools and printed circuit board manufacturing methods. This module must minimize its energy consumption and will be integrated into the network, which includes a central element responsible for collecting and processing information from remote sensors.

The aim of this module, which takes the form of a mini-project in teams, is to design and build a small network of communicating sensors. The teaching approach is strongly based on self-learning, enabling students to integrate the prerequisites necessary for this project while developing their autonomy. Additional resources (introduction to the communication protocol to be used, training in computer-aided electronic design, etc.) are provided during the project.In particular, each team has to design and build an electronic circuit from A to Z, comprising a sensor, a radio communication module and additional components, using computer-aided design tools and printed circuit manufacturing resources. This module must minimize its energy consumption; it will be integrated into the network including a central element responsible for retrieving and processing information from remote sensors.

Objectives

This module will enable engineering students to:

- Identify the necessary characteristics of a communication system (wired or wireless, speed, capacity, energy consumption, diameter, etc.).
- Choose an appropriate communication protocol.

Teaching hours

Practical	Practical work	36

Mandatory prerequisites

- Electricity
- Electromagnetism applied to information transmission
- Numerical Methods and Algorithms
- Instrumentation electronics: essential concepts for engineers
- Embedded systems

Course outline

- Specific concepts and cultural contributions necessary for technological choices in the design of communicating sensors.
- Embedded computer systems (microcontrollers, FPGAs, PSOCs, etc.)
- Wireless communication technologies (WIFI, Zigbee, Bluetooth, etc.)
- Integrated sensors (analog or digital)
- Energy sources (batteries, ambient energy recovery)

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

UE701 SHES - Languages

ECTS
8 credits

Polytech Annecy-Chambéry

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Support (half of Thursday afternoons when FISA staff are present)	MODULE				

	Nature	CM	TD	Practical work	Credits
Management	MODULE		32		
Business Structure and Entrepreneurship 2	MODULE	12 hours	12		
Sustainable development - Product approach	MODULE	4	2	8	

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved)	MODULE		34 hours		
English (TOEIC level achieved)	MODULE		34 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Support (half of Thursday afternoons when FISA volunteers are present) (ACCO701_PCHY)

Polytech Annecy-Chambéry component

In brief

- **Teaching methods:** In person **Teaching**
- **format:** Tutored project **Open to exchange**
- **students:** Yes

Presentation

Description

This support is open to all students at the school: students, apprentices, and employees in continuing education. It is not mandatory, as it is primarily intended for students who need it to succeed in their training.
This semester, it is scheduled into the timetable for each course, with a total of 16 hours.
Support may take the form of refresher courses, upgrading courses, or support in the main areas of the training programs.
Peer tutoring is encouraged and the educational resources of the Polytech Network are used (https://eplanet.polytech-reseau.org/).

Objectives

Promoting success for all students in their educational journey

Teaching hours

PTUT	Tutored project	16

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Director of Training, Polytech

Locations

Le Bourget-du-Lac (73)

Management (SHES701_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Teaching hours

Tutorial	Tutorials	32

Skills acquired

Macro-skills	Micro-skills

Practical information

Locations

Le Bourget-du-Lac (73)

Business Structure and Entrepreneurship 2 (SHES702_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

The entire training program is structured around a scenario involving an industrial company that manufactures coffee makers and combination units over a period of six years of activity.

- around a scenario involving an industrial company manufacturing coffee makers and coffee machines over a period of six years.
- with practical exercises focusing on:
- Provisional financial statements, dashboards, financial analysis, cost calculation, return on investment, and business strategy.
- Management projects initiated by engineering students in companies

Objectives

This course aims to enable students to:	Level	At the end of this course, students will be able to:
apply the concepts covered in the management module in a practical way	Mastery	use management concepts in the context of business projects
develop financial reflexes for steering the company according to the uncertainties, opportunities, and markets encountered	Master	Make decisions during projects based on available financial information

Teaching hours

Lectures		Lecture	12
Tutorial		Tutorials	12

Mandatory prerequisites

- Have completed the previous course
- Have completed a management project in your company

Course outline

Formation of company groups

Simulation of company life

Review and feedback

Bibliography

Business Strategy - Concepts, Models, Tools, Examples (2nd edition)

Dominique Jolly (Author)

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Jean-Patrick Plassiard

+33 4 79 75 81 17

Jean-Patrick.Plassiard@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Sustainable Development - Product Approach (SHES711_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

This course is divided into several parts:

- an introduction to environmental issues in business,
- a focus on the eco-design approach (definition, tools, and methods),
- the methodology for analyzing the life cycle of products or services,
- an overview of regulatory constraints
- insight into how companies can benefit from the approach.

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
understand the eco-design approach and the main challenges of its application in business	Application	take environmental issues and regulations into account when designing a product or service

Teaching hours

Lectures	Lecture	4
Tutorial	Tutorials	2
Lab	Practical work	8

Mandatory prerequisites

Basic environmental concepts

Product design concepts

Course outline

The course is followed by two practical sessions:

- a session on learning how to assess the environmental impacts of a product
- a session on implementing an eco-design approach in a company

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Jean-Patrick Plassiard

+33 4 79 75 81 17

Jean-Patrick.Plassiard@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

English (TOEIC level not achieved) (LANG710_PCHYFISA)

Polytech Annecy-Chambéry

In brief

- **Teaching methods:** Hybrid **Teaching**
- **format:** Tutorials **Open to exchange**
- **students:** Yes

Presentation

Description

This course prepares students for the TOEIC ("Test of English for International Communication") exam, specifically to obtain a minimum score of 785 points (out of 990).

With the aim of developing all four skills, this course also serves as an introduction to public speaking through presentations given by students in groups or individually on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate, as well as written work). Depending on the location (Annecy or Chambéry), some will be seen at different times during the semester, the year, or even the three years of training.

Students are assessed throughout each semester. The final assessment consists of a 1-hour, 1.5-hour, or 2-hour exam, depending on the semester and location (Annecy or Le Bourget).

Objectives

Specific objectives: at the end of this course, students will be able to:

revise grammar on: the correct reflexes of common structures; the verb group and tenses (except the conditional tense); the noun group and all its constituent elements; logical links (connecting words)

improve their grammatical and lexical knowledge (general English and TOEIC-specific vocabulary) in class and independently, validating their progress through regular assessment tests.

Teaching hours

Tutorials	Tutorials	34

Mandatory prerequisites

CEFR level B1

Course outline

1. Oral
   1. Elements of phonology
   2. Grammar (tenses, questions, adjectives.....)
   3. Reinforcement of structures and vocabulary
   4. Interactive oral communication
   5. Introduction to and practice for the TOEIC (listening section)
2. Writing
   1. Review of grammatical elements (tenses, questions, adjectives, etc.)
   2. Review of lexical elements (TOEIC-specific vocabulary)
   3. Reading comprehension of authentic texts
   4. Introduction to and practice for the TOEIC (reading section)

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator

Christophe Lambert
+33 4 79 75 94 16
Christophe.Lambert@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

English (TOEIC level achieved) (LANG711_PCHYFISA)

Polytech Annecy-Chambéry

In brief

- **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course aims to enable students to communicate authentically with linguistic and cultural autonomy. Emphasis is placed on authentic pronunciation and the ability to interact orally on a variety of topics.

Objectives

Communicate orally in interactive situations with pronunciation close to an authentic model.

Teaching hours

Tutorial	Tutorials	34

Mandatory prerequisites

Have validated level B2 in an official TOEIC or Linguaskill certification (see study regulations for details)

Course outline

Review of the basics of English pronunciation (sounds, phonemes, word stress, sentence stress, prosody, etc.), practical exercises, regular exposure to communication situations.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Christophe Lambert
+33 4 79 75 94 16
Christophe.Lambert@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

UE702 Work experience

ECTS
10 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 2 (launch and follow-up)	MODULE	1			8
Progress in the workplace (advancement)	MODULE	hour			

Practical information

Locations

Annecy-le-Vieux (74)

Project 2 (launch and follow-up) (PROJ701_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

In this module, engineering students will be required to carry out a mainly technical project within the company, implementing a structured and effective approach.
The technical component is considered in a broad sense (products, production processes, organization, etc.).
This project may be continued in semester 8, during which engineering students will develop its economic component. If company constraints do not allow this, it will be possible to choose a new project.

Objectives

Situate your project within the company's overall strategy and understand its challenges:
- Assess the importance of your project in relation to other ongoing projects
- anticipate and take into account changes within the company to ensure the project's sustainability Broaden the range of possible solutions:
- justify your choices

- systematically integrate relevant health, safety, and environmental aspects

Teaching hours

Lectures	Lecture	1
Lab	Practical work	8

Mandatory prerequisites

PROJ601_PCHYFISA

Course outline

Introduction
Support: framing of technical missions/projects, implementation of project management/problem-solving tools/methods, taking a step back from the project - confidentiality, approach, choices, personal development, etc.
Interim oral presentation accompanied by a written report (project summary sheet)

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Career development (progression) (STAG701_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

This assessment allows us to see the apprentice's progress during the various projects and tasks carried out within the company. The semester 7 assessment relates to the Extended Technical project.

Objectives

Be a good engineer and have good relationships with others:
- get involved
- be organized
- make decisions

- solve problems
- take responsibility

Course outline

Writing the project orientation sheet. Evaluation
by the company.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Places

Le Bourget-du-Lac (73)

UE703 Engineering Sciences

ECTS
12 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Automatic - Stability and control of systems Random signals	MODULE	10 hours	10.5	4 p.m.	2 credits
Embedded Systems and Concurrent Programming	MODULE	12h	3h	12 p.m.	
Data acquisition systems - Graphical programming EMC	MODULE	9 hours	9	12 a.m.	
	MODULE	4.5 hours		32 hours	
	MODULE	9		12	

Practical information

Locations

Annecy-le-Vieux (74)

Automatic - Stability and Control of Systems (EASI744_SNIFISA_CHY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching**
- **methods:** In person **Open to exchange**
- **students:** Yes

Presentation

Description

Study of the stability and control of continuous linear dynamic systems.

Objectives

Be able to analyze the stability of a system (open loop) or a control system (closed loop) based on its transfer function (continuous time).

Master the concept of closed-loop control.

Be familiar with standard controllers (P, PI, PID) and know how to synthesize them (model method) to guarantee the desired closed-loop performance.

Teaching hours

Lectures	Lecture	10
Tutorial	Tutorials	10.5
Lab	Practical Work	16 hours

Mandatory prerequisites

Module EASI641 (Signals and Systems)

Course outline

1. Introduction

1.1. Concept of system stability

1.2. Concept of closed-loop systems (closed-loop control)

2. Stability of linear dynamic systems

2.1. Introduction

2.2. A few reminders about linear systems (EASI641)

2.3. Stability condition

2.4. Routh's criterion

2.5. Stability of closed-loop systems

3. Standard correctors

3.1. Introduction

3.2. The PID controller

3.3. Main actions (P, I, D, filtered D)

3.4. Standard controllers

4. Controller tuning using the model method

4.1. The problem

4.2. First-order process

4.3. Second-order processes

Additional information

None.

Bibliography

"Automatique - Systèmes linéaires, non linéaires, à temps continu, à temps discret, représentation d'état" (Automation - Linear, nonlinear, continuous-time, discrete-time systems, state representation), Yves GRANJON, 4th edition, 2021, DUNOD.

"Basic Automation - Lectures and Corrected Exercises," Mohamed DAROUACH, Philippe PIERROT, Michel ZASADZINSKI, 2019, ELLIPSES.

"Behavior of Servo Systems," Christophe FRANCOIS, 2014, ELLIPSES.

"Continuous Linear Systems Control - Exercises and Methods," Yves GRANJON, 2022, DUNOD. "Control Systems - Linear

and Continuous Systems," Sandrine LE BALLOIS, Pascal CODRON, 2nd edition, 2006, DUNOD. "Automation - Control and

Regulation," Patrick PROUVOST, 2nd edition, 2010, DUNOD.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Pascal Mouille
+33 4 50 09 65 81
Pascal.Mouille@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

Random signals (EASI741_SNIFISA_CHY)

Polytech Annecy-Chambéry
Component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

At the end of this module, students will be able to

- define the properties of a random process and the ergodicity theorem
- explain the estimators of the statistical properties of a random process in digital form (autocorrelation, spectral density, etc.)
- illustrate with a few applications in optimal filtering, detection, estimation, etc.

Objectives

Analyze 1D signals containing a random noise component.

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12
Lab	Practical Work	12

Mandatory prerequisites

EASI642 - Fundamentals of Signal Processing

Course outline

1. Random Signals
   1. Random variables,
   2. Random signals,
   3. Statistical properties: distributions, independence, stationarity,
   4. Temporal properties: ergodicity, Frequency representation of stationary random signals in the broad sense,
   5. Linear operations on random signals
2. Estimation:
   1. General definitions related to estimation,
   2. Estimation of the autocorrelation function,
   3. Estimation of the DSP
3. Adaptive filtering
   1. Introduction,
   2. Wiener filter,
   3. Exact and weighted least squares,
   4. Recursive Least Squares (RLS),
   5. Adaptive filtering using the gradient algorithm (LMS)

Titles of practical assignments in Python

- Lab 1: Autocorrelation function
- Lab 2: Power spectral density. Conventional spectral analysis
- Lab 3: Adaptive filtering

Additional information

This module will then be used in image processing and in the deep learning module. There is also a strong link with embedded system modules, as the processing can obviously be embedded.

Bibliography

- Signal processing methods and techniques. Jacques Max and Jean Louis Lacoume - 5th edition Dunod
- Adaptive filtering: theory and algorithms. François Michaud and Maurice Bellanger - Hermès

Skills acquired

Practical information

Contact

Course coordinator

Guillaume Ginolhac

+33 4 50 09 65 83

Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Embedded Systems and Concurrent Programming (INFO741_SNIFISA_CHY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

This module covers the operation of embedded systems running on an operating system. It also presents the constraints associated with real-time and multitasking issues. Finally, this course addresses the implementation of a real-time embedded system based on specifications.

Objectives

1. Embedded system operation: programmable circuit architecture, development tools
2. Real-time processing: constraints, order of priority (interrupt-driven operation), adapting multitasking programming to real time
3. Development of a real-time application on an embedded system: use of the Raspberry Pi platform (with embedded Linux), application development, testing and validation, link with signal/image/video processing

Teaching hours

Lectures	Lecture	9
Tutorial	Tutorials	3
Lab	Practical work	24

Mandatory prerequisites

C programming

Embedded systems I

Course outline

1. Embedded systems operation: programmable circuit architecture, development tools
2. Real-time processing: constraints, priority order (interrupt-driven operation), adapting multitasking programming to real time
3. Developing a real-time application on an embedded system: using the Raspberry Pi platform (with embedded Linux), developing the application, testing and validation. Communication with microcontrollers and networks

Additional information

This module will then be used in S10 projects and for the Internet of Things

Targeted skills

Develop an embedded monitoring system using concurrent programming and communicate with other embedded systems.

Bibliography

- http://www.yolinux.com/TUTORIALS/LinuxTutorialPosixThreads.html
- https://computing.llnl.gov/tutorials/pthreads/index.html

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Guillaume Ginolhac
+33 4 50 09 65 83
Guillaume.Ginolhac@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Campus

Annecy / Annecy-le-Vieux campus

Data Acquisition Systems - Graphical Programming (PACI742_SNIFISA_CHY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

Program digital data acquisition/generation systems using a graphical language (LabVIEW).

Objectives

Understand the different components of the analog or digital signal acquisition chain. Implement the various

possibilities offered by an acquisition device connected to a computer.

Design, based on the description of an instrumentation requirement, the software application that uses the acquisition/generation hardware implemented.

Teaching hours

Lectures	Lecture	4.5
Lab	Practical work	32

Mandatory prerequisites

Must have completed modules EASI501 and PACI741 or possess equivalent knowledge.

Course outline

1. Digital acquisition/generation system: architectures, performance, and programming
2. Digital-to-analog and analog-to-digital converters *(review)*
    1. Digital-to-analog converters: structures, operating principles, and performance
    2. Analog-to-digital converters:
        1. Voltage-balanced: Structures, principles, and performance
        2. Charge-balancing: Structures, principles, and performance
        3. Sigma/Delta Converters

Additional information

N/A

Bibliography

- Francis COTTET, LabVIEW: Programming and Applications, DUNOD
- Francis COTTET, Signal Processing and Data Acquisition, DUNOD
- NI website: www.ni.com

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Michelle Passard

+33 4 50 09 66 01

Michelle.Passard@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

CEM (EASI743_SNIFISA_CHY)

ECTS
2 credits

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Presentation

Description

EMC analysis methods and tools for studying signal integrity in electronic circuits. Presentation of certification standards.

Objectives

Provide the theoretical and technical tools to analyze disruptive phenomena related to high-frequency and very fast signals in electronic circuits. Application to CAD for high-density integrated electronic boards operating at high frequency or high speed.

Teaching hours

Lectures	Lecture	9
Tutorial	Tutorials	9
Lab	Practical Work	12

Mandatory prerequisites

Basic electronics, signal propagation on lines and in free space.

Course outline

EMC areas in electronics

Methods for analyzing crosstalk in transmission systems, Localized electromagnetic

couplings

Distributed electromagnetic coupling on links Strong coupling and

propagation in common or differential modes

Applications to integrated circuits, connectors, and cables. NEXT and FEXT parameters

Methods and techniques for reducing EMC interference in circuits

Practical work content – project: CAD design of an electronic board taking into account EMC rules. Measurement of interference induced by a power supply (chopper).

Bibliography

EMC and the Printed Circuit Board Mark I. Montrose Wiley-IEEE Press

Alain Charroy, EMC Interference and Disturbances in Electronics (Volumes 1 to 3), DUNOD, 2006

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Cedric Bermond

+33 4 79 75 81 28

Cedric.Bermond@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

UE801 SHES - Languages

ECTS
5 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Support (half of the Thursdays when FISA is present)	MODULE				

	Nature	CM	Tutorial	Practical	Credits
Management and technical communication	MODULE	6	4	12	

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved)	MODULE		40 hours		
English (TOEIC level achieved)	MODULE		40 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Support (half of the Thursdays when FISA is present) (ACCO801_PCHY)

Polytech Annecy-Chambéry component

In brief

- **Teaching methods:** In person **Teaching**
- **format:** Tutored project **Open to exchange**
- **students:** Yes

Presentation

Description

This support is open to all students at the school: students, apprentices, and Continuing Education employees. It is not mandatory, as it is primarily intended for students who need it to succeed in their training.
This semester, it is scheduled in the timetable for each course, with a total of 16 hours.
Support may take the form of refresher courses, upgrading courses, or support in the main areas of the courses.
Peer tutoring is encouraged and the educational resources of the Polytech Network are used (https://eplanet.polytech-reseau.org/).

Objectives

To promote the success of all students in their training program

Teaching hours

PTUT	Tutored project	16

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Director of
Polytech Training

Locations

Le Bourget-du-Lac (73)

Management and Technical Communication (SHES801_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

The objective of this module is:

- to provide future engineers with the main tools for self-awareness, enabling them to communicate more effectively and take on their future responsibilities in a positive manner, whether functional or hierarchical;
- to support future engineers, through progressive methodological steps, in the management and reporting of their various projects.

Objectives

This course aims to enable students to:	Level	At the end of this course, students will be able to:
define the main tools for self-awareness to enable them to communicate better and take on their future responsibilities in a positive manner, whether functional or hierarchical	Mastery	communicate appropriately
		assume their future responsibilities
lead and report on their various projects	Mastery	in preparing reports and presentations on projects carried out in the company

Teaching hours

Lectures	Lecture	6
Tutorial	Tutorials	4
Lab	Practical work	12

Mandatory prerequisites

This course aims to enable students to:	Level	By the end of this course, students will be able to:
define the main tools for self-awareness to enable them to communicate better and take on their future responsibilities in a positive manner, whether functional or hierarchical	Master	communicate appropriately
		assume their future responsibilities
manage and deliver various projects	Proficiency	in preparing reports and presentations on projects carried out in the company

Course outline

1. Inventory of the main strategic, technological, and organizational changes at work in the company and in society, and their consequences on human resource management: historical and sociological retrospective
2. In-depth exploration of the concept of responsibility and accountability
3. Personal development:
   - basics of responsible and assertive communication
   - Transactional Analysis approach: self-diagnosis of "ego states," conditioning messages, life positions

Practical work titles

- Acquisition of project terminology (challenges, objectives, indicators, resources, constraints, PDCA, validation, sustainability)
- Development of a "context" grid and definition of the qualities and expectations of a project manager based on Herrmann
- End of "technical" project period, "management" project: Monitoring and support work on projects; mutual field advice
- Methodological contributions: argumentation and demonstration
- Written/oral expression contributions

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator
Jean-Patrick Plassiard
+33 4 79 75 81 17
Jean-Patrick.Plassiard@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

English (TOEIC level not achieved) (LANG810_PCHYFISA)

Polytech Annecy-Chambéry

In brief

- **Teaching methods:** Hybrid **Teaching**
- **format:** Tutorials **Open to exchange**
- **students:** Yes

Overview

Description

This course prepares students for the TOEIC (Test of English for International Communication) exam, specifically to obtain a minimum score of 785 points (out of 990).

With the aim of developing all four skills, this course also serves as an introduction to public speaking through presentations given by students in groups or individually on topics illustrated by press articles or video materials (VTD: Video, Talk and Debate, as well as written work). Depending on the location (Annecy or Chambéry), some will be seen at different times during the semester, the year, or even the three years of training.

Objectives

Specific objectives: by the end of this course, students will be able to:

revise grammar on: the correct reflexes of common structures; the verb group and tenses (except the conditional tense); the noun group and all its constituent elements; logical links (connecting words)

improve their grammatical and lexical knowledge (general English and TOEIC-specific vocabulary) in class and independently, validating their progress through regular assessment tests.

Teaching hours

Tutorials	Tutorials	40

Mandatory prerequisites

CEFR level B1

Course outline

1. Oral
   1. Elements of phonology
   2. Grammar (tenses, questions, adjectives.....)
   3. Reinvestment of structures and vocabulary
   4. Interactive oral communication
   5. Introduction and training for the TOEIC (listening section)
2. Writing
   1. Review of grammatical elements (tenses, questioning, adjectives, etc.)
   2. Review of lexical elements (TOEIC-specific vocabulary)
   3. Reading comprehension of authentic texts
   4. Introduction and training for the TOEIC (Reading section)

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator

Christophe Lambert
+33 4 79 75 94 16
Christophe.Lambert@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

English (TOEIC level achieved) (LANG811_PCHYFISA)

Polytech Annecy-Chambéry

In brief

- **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course aims to enable students to communicate authentically with linguistic and cultural autonomy.

Objectives

Communicate orally in a professional context, using business English and scientific and technical vocabulary specific to the program of study.

Teaching hours

Tutorial	Tutorials	40

Mandatory prerequisites

Have validated level B2 in an official TOEIC or Linguaskill certification (see study regulations for details)

Course outline

- Learn how to describe how a technical object works
Review appropriate vocabulary and grammatical structures
- Learn how to describe the prospects and opportunities offered by new inventions
- Learn how to describe the context of a product
Describe the profile of a company or laboratory, advertise a product, describe a product

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Christophe Lambert
+33 4 79 75 94 16
Christophe.Lambert@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

UE802 Work experience

ECTS
7 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 2 (Monitoring and reporting)	MODULE			8 hours	
Career development (4 areas)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 2 (Monitoring and reporting) (PROJ801_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

In this module, engineering students will be required to carry out an economics-oriented project within their company (either a continuation of the project from semester 7 or a new project).
The aim of this project is for engineering students to understand the importance of economic factors in the smooth running of any industrial project and their impact on the company.

Objectives

Measure the importance of economic factors in the management of any project (decision to launch, investment guidelines and decisions, management and performance indicators) and for the effective management of all or part of a company (a department, a workshop, a production line, etc.):
- Use management knowledge in the management of a company project Master the
main economic and financial parameters of the company:
- take economic and financial data into account when undertaking an industrial project
Make the numbers "speak," know how to translate them clearly for their appropriation and use at operational levels of the company:
- present and use economic and management data for a project

Teaching hours

Practical work	Practical work	8
Other	Other	1

Mandatory prerequisites

PROJ601_PCHYFISA

Course outline

Support: framing of economic missions/projects, implementation of project management/problem-solving tools/methods, identification and testing of economic tools/concepts useful to the project
P2 project report and defense - presentations covering the two components of Technical and Management/Economics and meeting the associated expectations -

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Corporate Development (4 areas) (STAG801_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

This monitoring allows us to see the apprentice's progress throughout the various projects and tasks carried out within the company. The midterm review for semester 8 relates to the Management project.

Objectives

Be a good engineer and have good relationships with others:
- get involved
- be organized
- make decisions
- solve problems
- take responsibility

Mandatory prerequisites

STAG501_PCHYFISA; STAG601_PCHYFISA; STAG701_PCHYFISA

Course outline

Writing a project orientation sheet. Assessment by the company.

Skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

UE803 Engineering Sciences

ECTS
18 credits

Polytech Annecy-Chambéry
Component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Experimental physics, measurements, sensors, and instrumentation	MODULE	12 hours	12	24 hours	3.5 credits
FPGA and PSOC	MODULE	21 hours	9h	24 hours	5 credits
Image Analysis and Computer Vision	MODULE	15 hours	13.5h	24 hours	
Networks and security for embedded systems Signal processing processor (DSP)	MODULE	25.5 hours	10.5	36 hours	2.5 credits
		10.5 hours		16 hours	

Practical information

Locations

Annecy-le-Vieux (74)

Experimental physics, measurements, sensors, and instrumentation (PACI841_SNIFISA_CHY)

ECTS
3.5 credits

Polytech Annecy-Chambéry

In brief

- **Languages of instruction:** French **Teaching**
- **methods:** In-person **Open to exchange**
- **students:** Yes

Presentation

Description

The objective of this course is to learn how to choose a sensor for a given application in the fields of mechanical, fluidic, thermal, electrical, or electromagnetic measurement. To this end, the module covers concepts in metrology and describes how the main types of sensors and their associated conditioning electronics work.

Objectives

The objective of this course is to learn how to choose a sensor for a given application and implement it by combining it with the associated electronic measurement chain.

Evaluate the performance of the measurement device including the sensor.

Teaching hours

Lectures	Lecture	12
Tutorial	Tutorials	12
Lab	Practical Work	24

Mandatory prerequisites

Instrumentation electronics, general physics, general optics.

Course outline

1. **Metrology and Sensors**
   1. Definitions
   2. Measurable quantities
   3. Metrological characteristics
2. **Physical principles of sensors**
   1. Optical transducers
   2. Thermal transducers
   3. Magnetic transducers
   4. Mechanical transducers
3. **Sensor conditioning electronics**
   1. Passive sensors
   2. Wheatstone bridge
   3. Impedance bridges
   4. Active sensors
   5. Acquisition chain structures
   6. Common mode rejection
4. **Sensor study**
   1. Sensors for mechanical quantities: acceleration, velocity, force, position, and displacement
   2. Fluid sensors: pressure, velocity, flow rate
   3. Sensors for thermal quantities
   4. Optical sensors
   5. Micro-sensors

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator

Michelle Passard
+33 4 50 09 66 01
Michelle.Passard@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

FPGA and PSOC (INFO841_SNIFISA_CHY)

ECTS
5 credits

Polytech Annecy-Chambéry
Component

In brief

- **Teaching methods:** In person
- **Open to exchange students:** Yes

Presentation

Description

This course covers two families of programmable electronic components: microcontrollers integrating programmable digital and analog functions (PSOC) and reprogrammable circuits (FPGA).

Objectives

To enable students to acquire essential knowledge about programming the functions of embedded analog and digital electronics and to master the development chain of programmable components.

Design and understand complex FPGA-based systems. Know how to use IPs and reconfigurable processors. Master the design of synchronous digital circuits.

Teaching hours

Lectures	Lecture	21
Tutorial	Tutorials	9
Lab	Practical Work	24

Mandatory prerequisites

Programming in C language. Knowledge of analog and digital electronics (microcontrollers, amplifier circuits, and analog filters).

Basic knowledge of VHDL. Knowledge of FPGA architecture. Understanding of how a processor works.

Course outline

Part One: PSOCs

1. PSOC component architecture.

2. Analog circuits integrated into PSOC components (AOP, PGA, Mixer, etc.).

3. Digital circuits integrated into PSOC components (timers, counters, flip-flops, etc.).

4. Digital filters (FIR and IIR).

5. Interrupt management.

6. Direct Memory Access (DMA) management.

7. Programming chain.

Part Two: FPGAs

1. VHDL reminders
2. Synchronous design methodology
3. Microprocessors (architecture and performance)
4. Design reuse (IP, examples of reconfigurable processors, interface buses, and operating systems)
5. NIOS V processor (architecture and instruction set)

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Cedric Bermond
+33 4 79 75 81 28
Cedric.Bermond@univ-savoie.fr

Course coordinator Emilie Herault
+33 4 79 75 94 68
Emilie.Herault@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

Image Analysis and Computer Vision (EASI842_SNIFISA_CHY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French, English
- **Teaching methods:** In person **Teaching**
- **format:** Lecture **Open to exchange students:**
- Yes
- **ERASMUS reference:** Engineering and related techniques

Presentation

Description

Through this course, students deepen their initial knowledge of image processing introduced in EASI642 and the concepts of random signals (EASI742) acquired in the one-dimensional case. It consists of two parts: the first is dedicated to image analysis methods (segmentation, classification, etc.) and the second to image correlation techniques for object detection and motion measurement.

Objectives

This module first introduces the basics of image processing (filtering, segmentation, classification, etc.) and then object detection and motion measurement through image correlation.

Teaching hours

Lectures	Lecture	15
Tutorial	Tutorials	13.5
Lab	Practical Work	12

Mandatory prerequisites

EASI642 - Signals and images: basic operators

EASI742 - Random Signals

Course outline

I. Image analysis:

- Segmentation (region/contours)

- Detection/Classification

- Morphological filtering

II. Image correlation

- Object detection using 2D correlation

- Motion measurement by 2D correlation

- 3D modeling (optional)

Additional information

N/A

Bibliography

E. Arnaud, Visual computing - Computer vision - Feature extraction - Points of interest. Lecture notes.
F. Cabestaing, 3D reconstruction, epipolar geometry, and stereovision. Course.
F. Cabestaing, Dense stereovision epipolar rectification. Course.
Correlates Solutions, Digital Image Correlation: Overview of Principles and Software, SEM 2009 Workshop.
A. Dehecq, 2015, Analysis of Himalayan and Alpine glacier dynamics based on 40 years of Earth observation data. Doctoral thesis.

R. Fallourd, 2012, Monitoring Alpine glaciers by combining heterogeneous information: high-resolution SAR images and field measurements. Doctoral thesis.
J.P. Tarel, Introduction to object detection in images. Course.
Y. Yan, 2011, Fusion of displacement measurements from SAR images: Applications to seismo-volcanic modeling. Doctoral thesis.
B. Zitova and J. Flusser, 2003, Image registration methods: a survey. Image and Vision Computing, No. 21, pp. 977–1000

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Yajing Yan
+33 4 50 09 65 36
Yajing.Yan@univ-savoie.fr

Places

Le Bourget-du-Lac (73)

Networks and security for embedded systems (INFO843_SNIFISA_CHY)

Polytech Annecy-Chambéry component

Presentation

Description

This course will present computer and field networks with related security elements. The network section will be built step by step, starting with the hardware layer and working up the network stack to arrive at the most common abstractions in computer science. The security section will present the most common attacks on networks and how to protect against and detect them.

Objectives

- Understand how the different network layers work (transmission and modulation, sockets, TCP/IP/Ethernet, etc.)
- Understand the most common methods of attack and how to detect and protect against them.

Teaching hours

Lectures	Lectures	25.5
Practical	Practical work	36

Mandatory prerequisites

INFO501

Course outline

1. Physical layer and data link (Layers 1 and 2)
2. Network layer (layer 3, IP and addressing)

3. Transport layer (layer 4, TCP/UDP, sockets)
4. Application layer (HTTP, other protocols)
5. Network security (common attacks and prevention)

Targeted skills

- Be able to use the relevant tools according to the level in the layers where the student will be working
- Understand how the OSI stack and each of its layers work
- Be able to recognize cyberattacks and know how to protect against them

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)

Signal Processing Processor (DSP) (INFO844_SNIFISA_CHY)

ECTS
2.5 credits

Polytech Annecy-Chambéry component

In brief

- **Teaching methods:** In person
- **Open to exchange students:** Yes

Presentation

Description

This course explains how to efficiently program signal processing applications (sound, image, sensors, etc.) in a specialized processor called a DSP (Digital Signal Processor).

Objectives

Understand how signal processors work and use their specific features to program sound, image, and video processing applications, as well as the control laws of industrial controllers.

Teaching hours

Lectures	Lecture	10.5
Tutorial	Tutorials	10.5
Lab	Practical work	16

Mandatory prerequisites

Digital signal processing. Programming in C language.

Course outline

Definition of digital signal processing Digital
representation of a signal
Specific modules of a signal processing processor Performing
calculations in the processor
Programming digital filters

Bibliography

https://scem-eset.univ-smb.fr/wp-content/uploads/2021/09/Digital-Signal-Processors-Cours.pdf

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sylvain
Montagny
+33 4 79 75 86 86
Sylvain.Montagny@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

UE901 SHES - Languages

ECTS
7 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lecture	Tutorial	Practical	Credits
Legislation, labor law, occupational health, sustainable engineering, decarbonization	MODULE	18 hours	8	8	
GEPC, humanities, management, ergonomics	MODULE	28			

	Nature	CM	Tutorial	Practical	Credits
English (TOEIC level not achieved)	MODULE		26 hours		
English (TOEIC level achieved)	MODULE		26 hours		

Practical information

Locations

Annecy-le-Vieux (74)

Legislation, labor law, occupational health, sustainable engineering, decarbonization (SHES901_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

Legislation and labor law

Occupational health

Sustainable engineering and decarbonization

Objectives

This course aims to enable students to:	Level	By the end of this course, students will be able to:
define the scope of human resources and labor legislation	Application	use their knowledge of human resources and labor legislation in their company
analyze and deal with a situation	Application	apply legal concepts to a situation in the workplace
Know the main concepts of ergonomics	Application	apply the concepts of ergonomics in an industrial context
take into account the ergonomic dimension in their sectors of activity and responsibility	Application	to apply knowledge of ergonomics in company projects

Teaching hours

Lectures	Lecture	18
Tutorial	Tutorials	8
Lab	Practical Work	8

Mandatory prerequisites

Legal concepts covered in semester 5

Sustainable development modules from semesters 5, 6, and 7

Course outline

1. Legislation
   - Sources of labor law and judicial organization
   - Key elements of the employment contract
   - Working hours/salaries/paid leave
   - Employee representation
   - Elements of civil and criminal liability of managers and their employees
2. Ergonomics
   - Ergonomics (origin, definition, scope)
   - Workstation design
   - Physical fatigue
   - Mental fatigue
   - Thermal comfort
   - Visual comfort
   - Auditory comfort
   - Workstation analysis method and ergonomic approach
   - Contribution of ergonomics to the prevention of hardship
3. Sustainable engineering

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator
Jean-Patrick Plassiard
+33 4 79 75 81 17
Jean-Patrick.Plassiard@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

GEPC, Humanities, Management, Ergonomics (SHES902_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

Project management and

leadership Skills management

Objectives

Acquire an understanding of the collective dimension of day-to-day activity management and change management.	Mastery	Define skills management
		understand the challenges of job and skills management
		understanding the philosophy of GPEC and its direct link to company strategy
		to be familiar with common HR vocabulary: skills, qualifications, performance, jobs, etc.
		identify and understand the role of the engineer in the GPEC process
identify and understand the use of the main job and skills management tools (job map, job descriptions, skills frameworks, appraisal interviews, etc.)	Master	understand the principles behind the creation of these tools
		be able to write a simple job description
		recruit

		understand the recruitment process and its main stages
		identify pitfalls to avoid
understand the contingency of the recruitment process (depending on the profile, time available, budget, etc.)	Master	understand the legal framework for recruitment (basic concepts)
		understand the main stages of the recruitment interview
		understand judgment biases and be able to avoid them
		understand the basic principles of assessment tools (tests)

Teaching hours

Lectures	Lecture	28

Mandatory prerequisites

- The entire second-year module: personal development
- Definition of the "team management/leadership" project
- Knowledge of the company

Course outline

1. Leading and managing a project
   - Leading a team: taking on the role of leader or manager; status, roles, performance indicators, and team monitoring; adaptive management
   - The group: its personality, its evolution, the role of the leader, group phenomena (application to meeting facilitation)
   - Leading a "sensitive" project: lateralizing it, identifying and developing stakeholder roles, adapting to each type
   - Leading change: crisis or change, individual and collective emotional cost, qualities of the leader, successive stages and support
   - Managing conflict: preventive, curative, interindividual, and collective approaches, from conflict to negotiation: prerequisites for negotiation, range of tactics and strategies used

2. Skills management
   - Theoretical aspects

2.1.1.The history of skills management (career management, job management, etc.) 2.1.2.The

conventional and legal aspects of GPEC

2.1.3.Key definitions (distinction between job and position, skill and performance, etc.)

- The link between employment and remuneration (collective agreement, classification/rating, etc.)
- GPEC tools
- Creating a job map

2.2.2.Methodology for creating a job description

2.2.3.Skills frameworks

- Skills assessment
- GPEC as a strategic approach
- Developing a comprehensive action plan

2.3.2.Different ways of implementing GPEC

2.3.3.GPEC stakeholders

1. Recruitment
   - The recruitment process

3.1.1. Recruitment: a strategic business tool

3.1.2. The stages of recruitment

- The cost of recruitment
- The recruitment interview
- Interview conditions

3.2.2.Interview support

3.2.3.Conducting a job interview

- Judgment biases to avoid
- Tests
- Types of tests

3.3.2.Methods for the statistical construction of a test

3.3.3.Test validity

Practical work titles

- Simulations of difficult communication situations: listening, criticism, conflicts
- Formation of "project management" working groups
- Managerial insights in response to various "management/team leadership" projects
- Preparation for project presentations in the workplace

Bibliography

- CADIN Loïc, GUERIN Francis and PIGEYRE Frédérique (Eds.). – Human resource management: practice and theory. – 2nd ed. – Paris: Dunod, 2004
- DEFELIX Christian, DUBOIS Michel and RETOUR Didier. - GPEC: forward planning in crisis? – In: HRM in the face of crisis: HRM in crisis? – edited by Tremblay M. and Sire B. – Montreal: Presses des l'école des HEC, 1997

- DENIMAL Philippe. – Classification, qualification, skills: for action on organization and social dialogue. – 1st ed. – Paris: Editions Liaisons, 2004
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- LUSSATO Ariane – Recruitment tests – Que Sais-Je – Presses Universitaire de FranceMINTZBERG Henry. – Structure and dynamics of organizations. – 12th ed. – Paris: Editions d'Organisation, 1982
- PERETTI Jean-Marc (Dir.). – Tous DRH. – 2nd ed. – Paris: Editions d'Organisation, 2006
- PERMATIN Daniel. – Managing by Skills or How to Succeed Differently? – 1st ed. – Caen: Editions Management Société, 1999

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Jean-Patrick Plassiard

+33 4 79 75 81 17

Jean-Patrick.Plassiard@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

English (TOEIC level not achieved) (LANG910_PCHYFISA)

Polytech Annecy-Chambéry component

In brief

- **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course prepares students for the TOEIC ("Test of English for International Communication") exam, specifically to obtain a minimum score of 785 points (out of 990).

This goal focuses primarily on preparing for the TOEIC test, and most of the activities offered are geared toward this end.

Students are evaluated throughout each semester.

Objectives

Achieve level B2 (score of 785) on the TOEIC certification exam taken at the end of the semester.

Teaching hours

Tutorials	Tutorials	26

Mandatory prerequisites

CEFR level B1

Course outline

Grammar and vocabulary review related to the TOEIC test

Regular practice with shortened tests and detailed corrections Regular practice with tests

under exam conditions

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Christophe Lambert
+33 4 79 75 94 16
Christophe.Lambert@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

English (TOEIC level achieved) (LANG911_PCHYFISA)

Polytech Annecy-Chambéry

In brief

- **Teaching methods:** In person **Teaching format:** Tutorials **Open to exchange students:** Yes

Presentation

Description

This course prepares students for their entry into professional life. Conducting or participating in a meeting: vocabulary and structures related to this aspect while continuing to work on the four skills, but with an emphasis on realistic scenarios (role-playing, acquisition of technical vocabulary and business vocabulary, etc.). It also covers public speaking through presentations given by students in groups and/or individually. Students are assessed throughout the semester. Preparation for the engineering theme (English section compulsory) Mock interview in front of two members of the jury and half the class.

Objectives

To become as independent as possible in their future profession

Teaching hours

Tutorials	Tutorials	26

Mandatory prerequisites

LANG811 and valid TOEIC score

Course outline

Labels (country culture for international exchange) Preparation of CVs

and presentations of oneself and business projects

Bibliography

Various documents provided by speakers and students themselves

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator

Christophe Lambert
+33 4 79 75 94 16
Christophe.Lambert@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

UE902 Work experience

ECTS
10 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectures	Tutorial	Practical	Credits
Project 3 (Launch and follow-up)	MODULE	1 hour			8
Progress in the workplace (advancement)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 3 (Launch and monitoring) (PROJ901_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

In this module, engineering students will be required to carry out a management-oriented project within the company, implementing a structured and effective approach.
The managerial component is considered in a broad sense (hierarchical or cross-functional management, communication, team leadership, training, change management, conflict management, etc.).
The aim of this project is for engineering students to realize the importance and impact of the human factor on the smooth running of any industrial project.
This project may be continued in semester 10 and become the Engineering Project, expanding it to meet the end-of-program expectations.

Objectives

Develop an effective human approach to project management:
- anticipate the humanly sensitive stages of the project
- define the principles adopted for project management

- identify obstacles encountered and actions taken in response
- monitor and define the validation stages with a view to ensuring sustainability

Use human resources tools that are appropriate for the company, whether they are already in use or whether this project is an opportunity to propose new ones (skills, training, procedures, coordination, etc.):
- Implement human resources tools in projects carried out within the company
- if necessary, select new dedicated tools

Teaching hours

Lectures	Lecture	1
Lab	Practical work	8

Course outline

Launch
Support: human-centered project framing, implementation of project management/problem-solving tools/methods, identification and testing of human resources tools/approaches useful to the project, critical analysis and areas for improvement. Mid-term defense in the company, with an active visit organized and led by the engineering student.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Corporate Development (Progression) (STAG901_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

This monitoring allows us to see the apprentice's progress throughout the various projects and tasks carried out within the company. The midterm review for semester 9 relates to the Management project.

Objectives

Be a good engineer and have good relationships with others:
- get involved
- be organized
- make decisions
- solve problems
- take responsibility

Mandatory prerequisites

STAG501, 601, 701, 801

Course outline

Writing the project orientation sheet. Evaluation
by the company.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

UE903 Engineering Sciences

ECTS
13 credits

Polytech Annecy-Chambéry component

List of courses

	Nature	Lectu re	Tutorial	Pract ical	Credits
Low-power communication systems Real-time	MODULE	8		8	2 credits
operating systems Linux kernel for embedded	MODULE	hou		p.m	3.5 credits
systems Advanced machine learning	MODULE	rs		. 28	
Communication bus	MODULE	20		p.m	2.5 credits
Implementation of 32-bit microcontrollers	MODULE	hou	9	. 24	2.5 credits
		rs		p.m	
		12		. 20	
		hou		p.m	
		rs 9		.	
		hou		24	
		rs			
		3			

Practical information

Locations

Annecy-le-Vieux (74)

Low-power communication systems (INFO944_SNIFISA_CHY)

ECTS
2 credits

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching methods:** In person **Open to exchange students:** Yes

Overview

Description

This course details two Internet of Things protocols that reduce the energy consumption of embedded systems: Bluetooth Low Energy (BLE) and LoRaWAN.
In addition to these two protocols, an in-depth study of the low-power modes of STM32 microcontrollers is carried out.

Objectives

Reduce the energy consumption of connected objects.

Teaching hours

Lectures	Lecture	8
Practical	Practical work	20

Mandatory prerequisites

Knowledge of microcontrollers.

Course outline

The Bluetooth Low Energy protocol
The LoRaWAN protocol
Low Power Modes on STM32

References

https://scem-eset.univ-smb.fr/wp-content/uploads/2021/06/Mastering-Low-Power-in-STM32.pdf

https://www.univ-smb.fr/lorawan/

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Sylvain Montagny
+33 4 79 75 86 86
Sylvain.Montagny@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

Real-time OS and Linux kernel for embedded systems (INFO945_SNIFISA_CHY)

ECTS
3.5 credits

Polytech Annecy-Chambéry component

Presentation

Description

This course consists of two parts: real-time systems on the one hand, and the implementation of a Linux kernel for embedded electronics on the other.

The first part explains how to execute multiple tasks on a microcontroller, while ensuring that each task can be completed before a deadline specified in the specifications.

The second part allows students to design (compile and configure) a Linux kernel for an embedded processor from scratch. Students start with a set of specifications and develop a complete application based on a Linux kernel.

Objectives

Know how to define the tasks to be performed by a program
Know how to organize tasks in relation to each other (priorities, synchronization, access to resources) Know how to make tasks communicate with each other

Design a Linux kernel taking into account the limited resources of a system. Understand the modules that need to be added to a Linux kernel for it to function.

Teaching hours

Lectures	Lecture	20
Lab	Practical work	28

Course outline

Part 1: Real-time OS

- The difference between a conventional operating system and a real-time operating system
- The FreeRTOS/Zephyr real-time operating system
- Securing access to software and hardware resources
- Mechanisms for synchronizing tasks with each other Part 2:

Linux kernel for embedded systems

- What is a Linux operating system?
- How do you compile a Linux kernel?
- What are the modules of the Linux kernel?
- How do you access hardware devices from a Linux kernel?
- How do you create an application for a Linux kernel?

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sylvain Montagny
+33 4 79 75 86 86
Sylvain.Montagny@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

Advanced Machine Learning (DATA942_SNIFISA_CHY)

Polytech Annecy-Chambéry component

Presentation

Description

This module dedicated to machine/automatic/deep learning aims to build complex models that are not necessarily analytical from a set of simple mathematical operators/concepts and learning data. The goal is to discover, through the data and depending on the problem to be solved (decision-making, decision support, segmentation, classification, content search based on a query, etc.), optimal functions capable of breaking down the data to extract meaningful attributes and thus lead to sophisticated processing of digital information. These functions can be very parsimonious (shallow learning) or organized into several highly complex layers (deep learning). Built on several scientific disciplines (statistics, numerical analysis, optimization, computer science, etc.) and a fundamental component of artificial intelligence, machine learning is now used in many fields of activity.

Objectives

Choose an artificial intelligence method appropriate for solving a data analysis or data search problem, then justify your choice, and finally interpret and evaluate the results obtained.

Teaching hours

Lectures	Lecture	12
Lab	Practical work	24

Course outline

1. General issues
   1. Data (sets, massive, heterogeneous, etc.)

   2. Types of set problems with such data
   3. Formulating a deep learning problem on a dataset
2. Unsupervised learning (datasets)
   1. Direct data modeling
   2. Modeling deep attributes extracted from data
   3. Metrics and similarity measures on categorical attributes
3. Supervised learning (datasets)
   1. Data benchmarking
   2. Non-recurrent networks (mainly CNN)
   3. Recurrent networks (LSTM and variants)
4. Openness to other approaches on data sets
   1. Reinforcement learning
   2. Overfitting and open problems
   3. Adversarial generative models

Bibliography

A.M. Atto, Deep Convolutional Neural HyperSpaces and Deep Functional Analysis, ISTE Group, https://www.istegroup.com/en/product/deep-convolutional-neural-hyperspaces-and-deep-functional-analysis/

A. M. Atto, Convolutional Fractional Stochastic Fields and their Deep Learning, ISTE Group, https://www.istegroup.com/fr/produit/convolutional-fractional-stochastic-fields-and-their-deep-learning/

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Abdourrahmane Atto
+33 4 50 09 65 27
Abdourrahmane.Atto@univ-savoie.fr

Locations

Annecy-le-Vieux (74)

Communication bus (EASI944_SNIFISA_CHY)

ECTS
2.5 credits

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** English **Teaching methods:** In person **Open to exchange students:** Yes

Overview

Description

This course provides an overview of the main communication protocols between digital components (One-Wire, SPI, I2C, CAN, USB). Each protocol is studied and, for each one, a low-level library is implemented using the peripherals of an STM32 microcontroller.

Objectives

Learn about the main communication buses.

Understand the organization of a low-level driver.

Modular and hierarchical programming of an application.

Teaching hours

Lectures	Lecture	9
Lab	Practical work	20

Mandatory prerequisites

C programming, libraries, microcontroller peripherals.

Course outline

The One-Wire bus: understanding and creating a driver associated with a user application The SPI bus: understanding and creating a driver associated with a user application

The I2C bus: understanding and creating a driver associated with a user application The CAN bus: understanding and creating a driver associated with a user application The USB bus: understanding and creating a driver associated with a user application

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sylvain Montagny
+33 4 79 75 86 86
Sylvain.Montagny@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

Implementation of 32-bit microcontrollers (INFO946_SNIFISA_CHY)

ECTS
2.5 credits

Polytech Annecy-Chambéry component

Overview

Description

This course provides a practical methodology for developing applications on 32-bit microcontrollers. A wide range of technologies are covered, including bootloaders, DMA access, LCD displays, and more.

Objectives

Understand each technology presented.
Reproduce an application that implements these technologies and validate their operation on a 32-bit microcontroller.

Teaching hours

Lectures	Lecture	3
Tutorial	Tutorials	9
Lab	Practical work	24

Mandatory prerequisites

Programming in C language

Course outline

3D LCD display Bootloaders

DMA access

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Sylvain Montagny
+33 4 79 75 86 86
Sylvain.Montagny@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

Campus

Le Bourget-du-Lac / Savoie Technolac campus

UE001 Work experience

ECTS
22 credits

Polytech Annecy-Chambéry component

List of courses

	Type	Lectures	Tutorial	Practical	Credits
Project 3 (Monitoring and reporting)	MODULE			12 hours	
Career development (4 areas)	MODULE				

Practical information

Locations

Annecy-le-Vieux (74)

Project 3 (Monitoring and reporting) (PROJ001_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

This monitoring allows us to see the apprentice's progress throughout the various projects and tasks carried out within the company. The semester 10 assessment relates to the Engineering project.

Objectives

Be a good engineer and have good relationships with others:
- get involved
- be organized
- make decisions
- solve problems
- take responsibility

Teaching hours

Practical work	Practical work	12
Other	Other	2

Mandatory prerequisites

PROJ501_PCHYFISA; PROJ601_PCHYFISA ; PROJ701_PCHYFISA ; PROJ801_PCHYFISA ; PROJ901_PCHYFISA

Course outline

Writing the project orientation sheet.

Assessment by the company

Skills acquired

Macro-skills	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Places

Le Bourget-du-Lac (73)

Corporate Development (4 areas) (STAG001_PCHYFISA)

Polytech Annecy-Chambéry component

Presentation

Description

This assessment allows us to see the apprentice's progress during the various projects and tasks carried out within the company. The semester 10 assessment relates to the Engineering project.

Objectives

Be a good engineer and have good relationships with others:
- get involved
- be organized
- make decisions
- solve problems
- take responsibility

Mandatory prerequisites

STAG501_PCHYFISA; STAG601_PCHYFISA; STAG701_PCHYFISA; STAG801_PCHYFISA; STAG901_PCHYFISA

Course outline

Writing the project orientation sheet. Evaluation
by the company.

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Nicolas Begel
+33 4 50 09 65 05
Nicolas.Begel@univ-savoie.fr

Locations

Le Bourget-du-Lac (73)

UE002

ECTS
8 credits

Polytech Annecy-Chambéry component

List of courses

	Type	Lecture	Tutorial	Practical	Credits
Interdisciplinary project: Embedded AI	MODULE			36 hours	
Interdisciplinary project: embedded systems and robotics Internet of Things	MODULE	3	9	24 hours	

Practical information

Locations

Annecy-le-Vieux (74)

Interdisciplinary project: Embedded AI (PROJ002_SNIFISA_CHY)

Polytech Annecy-Chambéry component

In brief

- **Languages of instruction:** French **Teaching**
- **methods:** In person **Teaching format:** Practical
- work **Open to exchange students:** Yes
-

Presentation

Description

The objective of this module is to develop an information processing application (images) on an embedded system.

This project will therefore combine several skills: those acquired in information processing (particularly image processing and AI), those acquired in programming, and those acquired in embedded systems. The projects will be carried out in groups (typically 5 students). They will consist of four aspects:

- the creation of an image processing program that performs face recognition based on a machine learning algorithm

- implementing the program on an embedded system

- Project management work using methods (V, agile, etc.) and tools (planning, collaborative spaces, version management)

Objectives

The objective of this module is to apply image processing and machine learning algorithms for face recognition and then implement them on an embedded system.

Teaching hours

Practical	Practical work	36

Mandatory prerequisites

This project requires prerequisites in information processing (image processing in particular) and programming. Typically, these prerequisites correspond to the following modules:

- EASI642 - Signals and images: basic operators
- EASI741 - Random Signals
- EASI842 - Image Analysis and Computer Vision
- INfO501 - Numbering and Algorithms
- INFO743 - Networks and Distributed Systems
- Embedded Systems I and II
- Machine Learning

Course outline

This project module consists of sessions scheduled in the timetable (24 hours) and supervised by project tutors, as well as independent work. The module is organized as follows:

- 3 four-hour sessions presenting the necessary knowledge
- 3.5 sessions of team work
- 1/2 session for assessment (report, oral presentation and team demonstration, and individual interviews to assess the skills acquired)

Additional information

Module combining data processing and embedded systems, allowing students to use a number of skills acquired during the 3 years of training

Bibliography

Machine learning algorithms: https://scikit-learn.org/stable/

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator

Guillaume Ginolhac
+33 4 50 09 65 83
Guillaume.Ginolhac@univ-savoie.fr

Locations

- Annecy-le-Vieux (74)

Campus

- Annecy / Annecy-le-Vieux campus

Interdisciplinary project: embedded systems and robotics (PROJ003_SNIFISA_CHY)

Polytech Annecy-Chambéry component

Presentation

Description

This module aims to encourage students to reflect on and review their studies through a project involving robotics applications. This will enable them to apply their various technical and interpersonal skills to complete a short project on a new material target.

Objectives

Robotics project:

1. introduction to embedded systems used in robotics and their specific features
2. Implementation of processing procedures based on Turtle Bot 3.

Teaching hours

Practical work	Practical work	24

Mandatory prerequisites

- Encourage reflective and retrospective thinking on the various concepts covered during the course
- Be able to supervise a small-scale project
- Demonstrate a solid understanding of the various tools covered in previous classes

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)

Internet of Things (INFO041_SNIFISA_CHY)

Polytech Annecy-Chambéry component

Presentation

Description

The objective of this course is to raise students' awareness of the importance of the IoT. It presents the fundamental concepts of the Internet of Things and describes the design chain for connected objects.

Objectives

The objective of this course is to raise students' awareness of the importance of the IoT. It introduces the fundamental concepts of the Internet of Things and describes the design chain for connected objects.

Teaching hours

Lectures	Lecture	3
Tutorial	Tutorials	9
Lab	Practical work	24

Mandatory prerequisites

Embedded Systems, Networks, and Security

Course outline

1. Introduction
2. The IoT market
3. Fundamental Concepts
4. Interactions between the "digital world" and the "physical world"

5. Infrastructures for the IoT
6. Technological solutions
7. Application examples
8. 24-hour IoT project development project on the following topics (examples)
    1. Design and development of an IT infrastructure monitoring application
    2. Interface between a cyber-physical system and the IFTTT service

Skills acquired

Macro-skill	Micro-skills

Practical information

Contact

Course coordinator Antoine Lavault

Locations

Annecy-le-Vieux (74)